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CANOTIA

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CANOTIA

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An introduction to the Vascular Plants of Arizona project can be found in **Canotia** vol. 1.
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Canotia publishes botanical and mycological papers related to Arizona. These may include contributions to the Vascular Plants of Arizona project, checklists, local floras, new records for Arizona and ecological studies. All manuscripts are peer-reviewed by specialists. Acceptance for publication will be at the discretion of the editor. At least 30 printed copies of each issue are distributed to libraries in the United States, Europe, and Latin America. Anyone may download copies free of charge at <http://lifesciences.asu.edu/herbarium/canotia.html>. Printed copies of this issue are being made possible through a grant from the Arizona Native Plant Society.

Canotia is named for *Canotia holacantha* Torr. (Celastraceae), a spiny shrub or small tree nearly endemic to Arizona.

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THE NEW YORK BOTANICAL GARDEN

PORTULACACEAE PURSLANE FAMILY

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Annual or perennial herbs; stems simple or branched, prostrate to erect. LEAVES cauline and opposite or alternate, or all basal, often fleshy; stipules present as axillary hairs or absent. INFLORESCENCE racemose or cymose, terminal or axillary, or flowers solitary; bracts present or absent. FLOWERS actinomorphic, perfect; pedicellate or sessile; sepals 2 (rarely 5-9); petals 5-18; stamens 1-many; ovary superior or inferior (in *Portulaca*), of 1-many fused carpels, 1-loculed; placentation basal or free-central. FRUIT a 1-many-seeded capsule, splitting at apex by 2-3 valves or circumscissile. SEEDS smooth or sculptured. – Ca. 30 genera, 500 spp., cosmopolitan, especially w. N. Amer. Some genera are cultivated as ornamentals (*Lewisia*, *Portulaca*); leaves of a few species can be eaten as greens or pot herbs; roots of *Lewisia* were historically used by Native Americans as a starchy staple (Moerman 1998).

1. Ovary wholly or partially inferior; capsule circumscissile near middle..... *Portulaca*
- 1' Ovary superior; capsule with 2-3 valves or circumscissile from base.
 2. Plants perennial with fleshy taproots; leaves in a tight basal rosette *Lewisia*
 - 2' Plants annual or perennial with corms, rhizomes or stolons; leaves both basal and cauline.
 3. Sepals mostly deciduous; inflorescences not appearing secund; leaves articulate at base, not clasping, the attachment points round; capsule valves wholly or partly deciduous.
 4. Leaf blades terete or semiterete, 1-3 mm wide, or narrowly planate, 1(-2) cm wide (in *P. aurantiacus*); capsules promptly dehiscent, exocarp and endocarp not macroscopically differentiated and not separating, the valves deciduous; seeds smooth or ridged, with covering membrane. *Phemeranthus*
 - 4' Leaf blades broadly planate, 1-7 cm wide; capsules tardily dehiscent, exocarp and endocarp macroscopically differentiated and separating, exocarp valves deciduous, the endocarp valves persistent; seeds minutely tuberculate, without covering membrane *Talinum*

- 3' Sepals persistent; inflorescences somewhat to markedly secund (at least distally); leaves not articulate at base, somewhat to markedly clasping, the attachment points linear; capsule valves not deciduous.
 - 5. Cauline leaves opposite or absent; plants annual or perennial.
 - 6. Inflorescence subtended by perfoliate to linear bracts; cauline leaves generally 2; plants annual or perennial *Claytonia*
 - 6' Inflorescence bractless; cauline leaves generally more than 4; plants perennial *Montia*
 - 5' Cauline leaves alternate; plants annual.
 - 7. Inflorescence a simple elongate raceme; petals red to purple; capsules 3-valved *Calandrinia*
 - 7' Inflorescence a raceme or panicle of umbellate clusters; petals white to pink; capsules 2-valved (3-valved in *C. ambigua*) *Cistanthe*

Calandrinia Kunth

Allison Bair

Annual herbs. STEMS branched, several to many, prostrate to erect. LEAVES alternate, linear to spatulate, entire, succulent. INFLORESCENCE an elongated raceme; bracts leaf-like. FLOWERS few to many, pedicellate; sepals 2, ovate; petals 5, red to purple, rarely white; stamens 3-15. CAPSULE with 3 valves. SEEDS ovate to elliptic, black, smooth to finely reticulate. —Ca. 14 spp. in the temperate w. Americas. (for J. L. Calandrini, 1703-1758, Swiss botanist).

Calandrinia ciliata (Ruiz & Pav.) DC. ([leaves] ciliate). Red Maids. —Herbs to 30 cm tall, from slender to thick taproot. STEMS spreading, prostrate to ascending. LEAVES linear to oblanceolate, to 10 cm long, glabrous or ciliate. FLOWERS 2-15; pedicels 4-13 mm long; sepals 2.5 – 8 mm long; petals 4-11 mm long, red to purple. SEEDS 5-20, elliptic, finely reticulate, 1-2.5 mm long. —Sandy to loamy soil, sand and gravel washes, rocky slopes: Cochise, Gila, Graham, Maricopa, Mohave, Pima, Pinal, Santa Cruz, Yavapai cos.; 425-1550 m (1400 - 5100 ft); Feb-Jun; CA, OR, WA; w Mex., Guatemala, w S. Amer.

Cistanthe Spach Pussypaws

Allison Bair

Annual, biennial, or perennial herbs. STEMS simple or branched, spreading to ascending or erect. LEAVES in basal rosette or basal and cauline, linear to spatulate, entire, generally succulent. INFLORESCENCE a raceme or panicle of umbellate clusters, generally one-sided. FLOWERS few to many, pedicellate or sessile, each subtended by two unequal bracts; petals white to pink; sepals ovate, scarious or scarious-margined; petals 2-12; stamens 1-23; styles present or absent; stigmas 2-3, sessile or stalked. CAPSULE with 2-3 valves. SEEDS one to many, elliptic to round, black, smooth to sculptured. —Ca. 35 spp. distributed from N. to S. Amer.

Spach (1836) described the genus *Cistanthe* to accommodate several Chilean species that he segregated from *Calandrinia*. Recent cladistic investigations (Hershkovitz 1991) indicate that many other species also belong in *Cistanthe*. These include the Arizona species

formerly recognized as *Calandrinia ambigua*, *Calyptridium monandrum*, and *Calyptridium parryi*.

- 1. Basal rosette absent; flowers pedicellate; capsule 3-valved *C. ambigua*
- 1' Basal rosette well-developed (although withering at anthesis); flowers sessile;
capsule 2-valved
- 2. Sepals 1.5-5 mm long; capsules not more than twice as long as sepals *C. parryi*
- 2' Sepals 1-3 mm long; capsules two and a half or more times as long as sepals
..... *C. monandra*

Cistanthe ambigua (S. Wats.) Carolin ex Hershk. (of uncertain relationship). Desert pussypaws. —Annual herbs to 10 cm tall. STEMS spreading to erect. LEAVES all eauline, linear to spatulate, 1.5-5 cm long. INFLORESCENCE a panicle of umbellate clusters, up to 4 cm long; bracts leaf-like. FLOWERS pedicellate; pedicels 1-5 mm; sepals scarious-margined, ovate, 2.5-5 mm long; petals 3-5, white, 2-5 mm long; stamens 5-10; stigmas 3, stalked. CAPSULE with 3 valves, ovoid, 3-6 mm long, equal to or less than length of calyx. SEEDS 6-15, black, smooth, shiny. [*Calandrinia ambigua* (S. Wats.) T.J. Howell]. —Sand and gravel washes, rocky slopes, in desert scrub communities; La Paz, Mohave, Yuma cos.; 0 – 500 m (0 – 1700 ft); Feb-May; CA, Mex.

Cistanthe monandra (Nutt.) Hershk. (one-stamened). Common pussypaws. —Annual herbs to 16 cm tall. STEMS spreading to ascending. LEAVES in an ephemeral basal rosette, spatulate, to 7.5 cm long. INFLORESCENCE a 1-sided raceme, up to 3.5 cm; bracts ovate to elliptic. FLOWERS sessile; sepals scarious or scarious-margined, ovate, 1-3 mm long; petals 3, white to pinkish, 1-3 mm long; stamen 1; styles absent; stigmas 2, sessile. CAPSULE with 2 valves, ovoid to cylindric, 2.5- 8 mm long, two and a half or more times as long as sepals. SEEDS 1-10, black, smooth, shiny. [*Calyptridium monandrum* Nutt.] —Sand and gravel washes, rocky slopes, roadsides: Coehise, Gila, Graham, Maricopa, Mohave, Pima, Pinal, Santa Cruz, Yavapai, Yuma cos.; 400 – 1550 m (1400 – 5000 ft); Feb-May; CA, NV, Mex. (Baja C.).

Cistanthe parryi (A. Gray) Hershk. (for Charles Parry [1823-1890], surgeon and naturalist on Mexican Boundary Surveys). Parry's Pussypaws. —Annual herbs to 10 cm tall. STEMS spreading to ascending. LEAVES in an ephemeral basal rosette, spatulate, up to 7.5 cm long. INFLORESCENCE a 1-sided raceme, to 4.5 cm long; bracts ovate to elliptic. FLOWERS sessile; sepals scarious or scarious-margined, ovate, 1.5-5 mm long; petals 3, white to pinkish, 1.5-3 mm long; stamens 1-3; styles absent; stigmas 2, sessile. CAPSULE with 2 valves, ovoid to cylindric, 2-8 mm long, not more than twice as long as sepals. SEEDS 5-15, black, tuberculate to smooth, dull to shiny. —4 vars. (1 in AZ); CA to UT.

Var. **arizonica** (J.T. Howell) Kartesz & Gandhi (from Arizona). Arizona Pussypaws. —Seeds smooth, shiny. [*Calyptridium parryi* Gray var. *arizonicum* J.T. Howell]. —Sand and gravel washes, open areas: Graham, Pima, Pinal, Yavapai cos.; 800 – 1300 m (2600 – 4200 ft); Feb. - May; CA; Mex. (Baja C.).

Claytonia L. Spring Beauty

Marissa Howe

Annual or perennial herbs, with corms or taproots. STEMS simple or branched, erect. LEAVES: basal leaves none to many, entire; cauline leaves 2, opposite, distinct to fully

connate into a perfoliate disk; margins entire or cleft; apex sometimes apiculate.

INFLORESCENCE a stalked or sessile raceme or cyme, dense or open; bracts present,

minute. FLOWERS 1-28; sepals 2, ovate; petals 5, pink or white; stamens 5. CAPSULE

with 3 valves. SEEDS lens-shaped, brown to black, shiny. —Ca. 26 spp. (3 in AZ)

distributed from N. Amer. to e. Asia. Corms of *C. lanceolata* var. *rosea* and leaves of *C. parviflora* and *C. perfoliata* are edible (Moerman 1998). (for John Clayton, 1694-1773, plant collector).

1. Perennial herbs with corms; basal leaves none to few; cauline leaves free....*C. lanceolata*
- 1' Annual herbs with fibrous roots; basal leaves few to many; cauline leaves free, or connate and perfoliate.
2. Basal leaves linear to narrowly oblanceolate, tapered gradually to petiole *C. parviflora*
- 2' Basal leaves ovate, deltate or rhomboidal, truncate to cordate *C. perfoliata*

Claytonia lanceolata Pall. ex Pursh (lance-shaped [leaves]). Western Spring Beauty. — Erect perennial herbs to 21 cm tall, arising from a spherical corm, 0.8 – 2.6 cm wide. LEAVES: basal leaves none to few, ovate to lanceolate, cauline leaves usually 2, sessile to short-petiolate, linear to narrowly lanceolate. INFLORESCENCE a short simple or branched raceme or cyme. FLOWERS 1-9; sepals 2.7-8 mm long; petals 5 – 20 mm long, smooth at tip, white or pink, the base sometimes yellow. SEEDS 2.2 – 2.5 mm long, black. Widespread, woodlands and meadows throughout w N. Amer.

Var. *rosea* (Rydb.) R. J. Davis (rose-colored). —Basal leaves 1-2, attached to corm, ovate to lanceolate, 3.1-13.8 cm long, 0.6-1.8 cm wide. INFLORESCENCE subtended by a leafy bract with minute upper bracts in the inflorescence reduced to membranous scales. FLOWER petals 5-16 mm long. [*Claytonia rosea* Rydb.]. — Ponderosa pine and pinyon-juniper forests, in moist soil, often near the Mogollon Rim: Cochise, Coconino, Gila, Maricopa, Mohave, Navajo, Yavapai cos.; 1300-2300 m (4200–7500 ft); Feb-May; CO, MT, NM, UT, w Can.

The Arizona specimens are here all referred to *Claytonia lanceolata* var. *rosea*. In some recent floristic treatments (Weber 1990, Miller 2003) this taxon is recognized as *C. rosea* and separated from *C. lanceolata* based on the presence of basal leaves (vs. absent in *C. lanceolata*), multiple minute bractlets within the inflorescence (vs. bractlets absent in *C. lanceolata*), and petal length 8-10 mm (vs. 5-20 mm in *C. lanceolata*). Of these three characters, only the presence of basal leaves distinguishes the Arizona specimens as a distinct taxon, recognized here as a geographical variety. Basal leaves originate from the corm, so when the corm is absent from herbarium specimens the basal leaves are absent or disconnected. Thus lack of basal leaves is often a reflection of the quality of the collection (i.e., whether the specimen was dug up vs. pulled up). Out of the 32 specimens examined that had corms, only 4 were missing basal leaves. *Claytonia lanceolata* var. *rosea* needs experimental work to substantiate its recognition at the specific level.

Claytonia parviflora Douglas ex Hook. (small-flowered). Streambank Spring Beauty. —Annual herbs, to 15 cm tall, spreading to erect. LEAVES: basal leaves linear to narrowly oblanceolate, 1.9-12.8 cm long, 0.1-4 cm wide, tapering gradually to petiole; cauline leaves 2, free, or connate into a perfoliate disk with margins entire, sometimes with 2 apiculate or

mucronate tips. INFLORESCENCE a stalked or sessile raceme, dense or open, subtended by a single, often obscure bract. FLOWERS 3–19; sepals 1–2.5 mm long; petals 2.5–5 mm long, oblong, notched at tip, pink or white. SEEDS 1–1.5 mm long, black. —4 subspp. (3 in AZ); w N. Amer.

Based upon Miller's treatment for Flora of North America (2003) and annotated herbarium specimens, three subspecies of *Claytonia parviflora* have been recognized in Arizona. Subspecies *viridis* is morphologically distinct from the others because its cauline leaves are distinct vs. connate-perfoliate as in the other two subspecies. Subspecies *parviflora* and *utahensis* seem to be distinct only in their respective geographic ranges. Subspecies *utahensis* is found north of the Mogollon Rim, whereas subsp. *parviflora* is found s of the Mogollon Rim. We observed a large amount of variability in basal leaf shape, which, according to Miller, delimits these subspecies (see key below).

1. Cauline leaves free..... subsp. *viridis*
- 1' Cauline leaves connate.
 2. Basal leaves linear to narrowly oblanceolate; plants found south of the Mogollon Rim subsp. *parviflora*
 - 2' Basal leaves narrowly oblanceolate to spatulate; plants found north of the Mogollon Rim subsp. *utahensis*

Subsp. *parviflora* —LEAVES: basal leaves linear to narrowly oblanceolate, 6.3–12.8 cm long, 0.15–1 cm wide; cauline leaves connate and perfoliate. FLOWERS 4–14; sepals 1.2–2.5 mm long; petals 2.5–3 mm long, pink or white. SEEDS 1.2–1.5 mm long. $2n = 24, 36, 48$. [*Claytonia perfoliata* var. *parviflora* (Douglas ex Hook.) Torr.; *Montia perfoliata* var. *parviflora* (Douglas ex Hook.) Jeps.; *M. perfoliata* forma *parviflora* (Douglas ex Hook.) J. T. Howell]. —Moist areas: Gila, Maricopa, Pinal cos.; 800–1050 m (2600–3500 ft); Mar–May; CA, ID, MT, NV, OR, UT, WA; British Columbia, Can.; Mex. This subspecies may intergrade with other species of the *C. perfoliata* complex (Miller 2003).

Subsp. *utahensis* (Rydb.) John M. Mill. & K.L. Chambers (of the Utah region). Mohave Indian-lettuce. —LEAVES: basal leaves narrowly oblanceolate to spatulate, 2.2–12.4 cm long, 0.6–4 cm wide; cauline leaves connate and perfoliate. FLOWERS 6–19; sepals 1–2.3 mm long; petals 3–3.5 mm long, white. SEEDS 1.0–1.5 mm long. [*Limnia utahensis* Rydb.; *Claytonia perfoliata* var. *utahensis* (Rydb.) Poelln.; *Montia utahensis* (Rydb.) Pax & K. Hoffm.]. —Moist areas: Coconino, Mohave, Yavapai cos.; 900–1200 m (3000–3900 ft); Mar–Apr; CA, NV; Mex.

Subsp. *viridis* (Davidson) John M. Mill. & K.L. Chambers (green). Davidson's Indian-lettuce. —LEAVES: basal leaves linear to narrowly oblanceolate, 1.9–9.1 cm long, 0.1–0.5 cm wide; cauline leaves free. FLOWERS 3–9; sepals 1.9–2.5 mm long; petals 2.8–5 mm long, white or pink. SEEDS 1.3–1.4 mm long. $2n = 24, 36$. [*Montia spathulata* var. *viridis* Davidson, *M. spathulata* var. *temuifolia* (Torr. & A. Gray) Munz]. —Decomposed granite or sandstone, nw corner of AZ: Mohave Co.; 1200–1550 m (4000–5100 ft); Apr; CA, NV; Mex. This taxon intergrades with subspecies *parviflora* (Miller 2003).

Claytonia perfoliata Donn ex Willd. (connate-leaved). Miner's-lettuce. —Annual herbs to 30 cm tall, spreading to erect. LEAVES: basal leaves several, narrowly oblanceolate to ovate to deltate or rhomboidal, 1.2–19 cm long, 0.3–4.5 cm wide, the base abruptly tapered; cauline leaves 2, connate, perfoliate, disk-like, subtending the inflorescence; apex

apiculate or mucronate; margin entire or occasionally notched or cleft. INFLORESCENCE a stalked or sessile raceme, dense or open, subtended by a single, often obscure bract. FLOWERS 5-28; sepals 1.5-4.5 mm long, ovate; petals oblong, 1-3 mm long, pink or white, notched at tip. SEEDS 1.0-1.8 mm long, brown to black. [*Montia perfoliata* (Donn ex Willd.) Howell]. Moist areas, stream banks, or riparian areas in desert scrub to Ponderosa Pine/Gambel Oak habitat: Apache, Coconino, Gila, Graham, Maricopa, Mohave, Pima, Pinal, Yavapai cos.; 350-2200 m (1200-7300 ft); Feb-Jun; CA, CO, ID, MT, NV, OR, UT, WA, WY; British Columbia, Can. to C. Amer.

Based upon annotated herbarium specimens and the recent Flora of North America treatment (Miller 2003), two subspecies of *Claytonia perfoliata* have been recognized in Arizona, subsp. *intermontana* and subsp. *mexicana*. They are not recognized as distinct entities here because the characteristics used to delimit these subspecies are not consistent or are extremely difficult to see. Subspecies *intermontana* is distinguished from subsp. *mexicana* by beet red or green herbage and gas pockets on the basal leaves (vs. green herbage only and no gas pockets). These subspecies have different geographical ranges (Chambers 1993, Miller 1978); subsp. *intermontana* grows in northwestern Arizona (Yavapai and Mohave Cos.), and subsp. *mexicana* grows in central to southern Arizona. It has been suggested that the subspecies of *C. perfoliata* may be difficult to identify due to environmental plasticity, genetic mixing among polyploids, and geographic overlap of distinct self-pollinating forms (Miller 1978).

Lewisia Pursh Bitter Root

Robin Taylor

Perennial herbs with fleshy taproots. STEMS simple or branched, prostrate to erect. LEAVES all basal, sessile or petiolate, linear to spatulate, glabrous; margins entire. INFLORESCENCE solitary or cymose; bracts present. FLOWERS 1-60, sepals 2 and green or 5-9 and petal-like, orbicular-ovate; petals 5-15, white to dark pink; stamens 5-50; styles 3-9, branched. CAPSULE circumscissile near base. SEEDS many, round, black, smooth. 16 species throughout w N. Amer. (for Meriwether Lewis, 1774-1809, of the Lewis and Clark expedition). Roots of most species were peeled and dried as a winter food by Native Americans (Moerman 1998).

1. Sepals 6-8, cream to pink; leaves ephemeral, withering before flowers appear..... *L. rediviva*
- 1' Sepals 2, green; leaves persistent.
 2. Bracts appearing sepal-like, closely subtending flowers; leaves 1-12 mm wide; capsules 6-9 mm wide *L. brachycalyx*
 - 2' Bracts leaf-like, well below flowers; leaves 0.5-4 mm wide; capsules 4-5 mm wide *L. pygmaea*

Lewisia brachycalyx (Engelm.) A. Gray (short-sepaled). —TAPROOT 1.2-9.8 cm long. STEMS prostrate to sub-erect, 0.5-4.6 cm tall. LEAVES persistent, sessile, oblanceolate, 1.5-8.2 cm long, 0.1-1.2 cm wide; base truncate; apex rounded at tip. INFLORESCENCE bracts sepal-like, closely subtending the flowers. FLOWERS 2-26; sepals 2, ovate, 0.3-1 cm long, the tip acute, the margins entire; petals 5-8, white with pink veins, 0.6-2.6 cm long; stamens 9-15; styles 5-8. CAPSULE 6-9 mm long. SEEDS 1-1.8

mm long. —Sandy loam/sandstone slopes in conifer forests, often in streambeds: Apache, Coconino, Gila, Navajo, Yavapai cos.; 1100-2300 m (3,400-7,500 ft); Mar-Jun; CA, UT; Mex.

Lewisia pygmaea (A. Gray) B.L. Robins (dwarf). Pygmy Bitter Root or Alpine Lewisia. —TAPROOT 1-15 cm long. STEMS prostrate to suberect, 1-6 cm tall. LEAVES persistent, petiolate, linear to narrowly spatulate, 1.2-10.2 cm long, 0.5-4 mm wide; base long attenuate; apex acute to rounded. INFLORESCENCE bracts leaf-like, positioned well below flowers. FLOWERS 1-60; sepals 2, orbicular to ovate, 0.4-1.1 cm long; petals 5-9, white to dark pink, 0.4-1.3 cm long; stamens 5-8; styles 3-6. CAPSULE 4-5 mm long. SEEDS 1 mm long. —Meadows and conifer forests often among oaks and ferns: Apache, Coconino, Navajo cos.; 2400-3500 m (8,000-11,600 ft); May-Aug.; w U. S.; Can.

Lewisia rediviva Pursh (reviving from a dry state). —TAPROOT 6.0 – 8.3 cm long. STEMS prostrate to erect, 1.0-4.8 cm tall. LEAVES withering at anthesis, sessile, linear to oblanceolate, acute to rounded at apex. FLOWERS 1-7; sepals 6-8, ovate, 0.9-1.7 cm long; petals 10-15, creamy-pink, 1-2.2 cm long; stamens 20-50; styles 4-9. CAPSULE 5-6 mm long. SEEDS 2-2.1 mm long. —2 vars. in western N. Amer. (1 in AZ).

Var. **rediviva** —LEAVES linear, cylindrical, 1.0-1.4 cm long, 1.5-2 mm wide. —Rocky substrates in pinyon-juniper woodlands: Coconino Co.; 1676-1850 m (5,500-6,069 ft); May-June; CA, CO, MO (w U.S.).

Montia L. Water-chickweed

Tina Ayers

Perennial herbs, with rhizomes and stolons. STEMS erect or decumbent, often rooting at nodes. LEAVES alternate or opposite, petiolate. INFLORESCENCE a 1-sided raceme, bractless above first flower. FLOWERS 2 to many; sepals ovate; petals 3-5; stamens 3-5. CAPSULE with 3 valves. SEEDS 1-3, black, smooth or warty. —Ca. 12 species, cosmopolitan; 8 in N. America. (for Guiseppe Monti, 1682-1760, Italian botanist).

Montia chamissoi (Ledeb.) Spreng. (for L.K.A. Chamisso (1781-1838)). Water miners-lettuce. —Stems 3-27 cm long, from rhizomes with pink bulblets. LEAVES opposite, oblanceolate to obovate, 0.5-5 cm long, 0.1-1.7 cm wide, entire, glabrous, attenuate; apex acute to round. FLOWERS 2-14; sepals 2-3 mm long; petals 5, white to pinkish, 5-8 mm long; stamens 5. CAPSULE 2-3 mm long. SEEDS warty, 1-1.5 mm long. —Moist areas, often in wet meadows: Apache, Coconino, Gila, Navajo cos.; 2100-3000 m (7,000 – 9,500 ft); May-Sep; Pacific States e to the Rocky Mountains, also IA, MN, PA.

Phemeranthus Raf. Fameflower, Flameflower

Robert W. Kiger

Perennial herbs, caulescent, glabrous. ROOTS fleshy to woody, sometimes tuberous. STEMS simple or branching, spreading to erect, very short to elongate, sometimes suffrutescent. LEAVES alternate or subopposite, sometimes subrosulate, sessile or petiolate, sometimes subtended by free basal enations; blades terete to narrowly planate, succulent or semisucculent. INFLORESCENCE in ours terminal or lateral cymes or cymules, or flowers solitary in leaf axils; peduncles sometimes scape-like. FLOWERS pedicellate or subsessile, sometimes sessile in *P. parviflorus*, each opening for 2-4 hours in the afternoon to early evening of a single day, sometimes facultatively cleistogamous in *P. aurantiacus*; sepals 2,

distinct, deciduous or persistent through capsule dehiscence; petals 5 or rarely more, distinct or sometimes basally connate, fugacious; stamens 4-many, the filaments distinct or basally coherent in several clusters; ovary superior, 3-carpellate, the ovules many, the placentation free-central; style 1; stigma(s) 1 and subcapitate or 3 and linear. CAPSULE promptly loculicidal from the apex, 3-valved; exocarp and endocarp not macroscopically differentiated and not separating; valves deciduous. SEEDS many, small circular-reniform and compressed, smooth or with parallel arcuate ridges, black or brown, covered with white or pale gray membrane. $x = 12$. -25-30 spp. Amer. (from Greek *ephemeros*, living for one day, and *anthos*, flower). Kiger, R.W. 2001. Novon 11:319-321.

Morphological and molecular data support the separation of *Phemeranthus* from *Talinum*. All of our species of this complex, except *Talinum paniculatum*, are placed in *Phemeranthus*.

1. Petals yellow to reddish-orange; seeds with arcuate ridges on sides.
 2. Flowers single or in 2-3-flowered cymules in the leaf axils *P. aurantiacus*
 - 2' Flowers in cymes borne on scape-like peduncles.
 3. Leaves terete, not appearing petiolate *P. humilis*
 - 3' Leaves flattened, appearing petiolate *P. marginatus*
- 1' Petals white, pink, or purplish; seeds without arcuate ridges.
 4. Sepals 5 mm or more long, persistent, equaling or exceeding mature capsule *P. brevicaulis*
 - 4' Sepals 4.5 mm or less long, deciduous or persistent and shorter than mature capsule.
 5. Stamens 5(-6) *P. parviflorus*
 - 5' Stamens (7-)10 or more.
 6. Leaves 15 mm or longer; stigma 1 *P. validulus*
 - 6' Leaves shorter than 15 mm; stigmas 3 *P. brevifolius*

Phemeranthus aurantiacus (Engelm.) Kiger (orange [-flowered]). —Herbs to 5 dm tall. ROOTS woody tuberous. STEMS simple or branching, erect, sometimes suffrutescent. LEAVES sessile; blades linear to lanceolate, rarely oblanceolate, basally attenuate, to 6 cm long. INFLORESCENCE lateral with flowers inserted singly or occasionally in cymules; pedicels often recurving in fruit. FLOWERS: sepals ovate, sometimes cuspidate, 5-10 mm long, deciduous; petals obovate, 9-15(-25) mm long, yellow to reddish-orange; stamens usually 20-30; stigmas 3, linear. CAPSULES ovoid to globose, 4-7 mm long. SEEDS with arcuate ridges on sides, 1.2-1.7 mm long. [*Talinum angustissimum* (A. Gray) Wootton & Standl.; *T. aurantiacum* Engelm.; *T. aurantiacum* var. *angustissimum* A. Gray]. —Desert scrub and grasslands, savannahs and open woodlands, in rocky soil, often granitic, sometimes calcareous: Cochise, Gila, Graham, Greenlee, Maricopa, Pima, Pinal, Santa Cruz, Yavapai cos.; 750-2000 m (2400-6600 ft); May-Oct; NM, TX; Chih., Coah., Dgo., N.L., S.L.P., Tamp., Zac., Mex. Quite variable in size, flower color, and capsule shape, with a continuum of intergradation over its range. Plants from s AZ with petals yellow, leaves very narrow, stems short and slender, and capsules small and globose are an extreme form sometimes recognized separately as *T. angustissimum*.

Phemeranthus brevicaulis (S. Wats.) Kiger (short-stemmed). —Herbs to ca. 6 cm tall. ROOTS fusiform, somewhat woody. STEMS branching, spreading-ascending, sometimes suffrutescent. LEAVES sessile, to 25 mm long, the upper terete or subterete, the lower

flatter, wider, somewhat shorter. INFLORESCENCE terminal cymes or cymules, sometimes from very short sub-branches and appearing lateral, sometimes only 1-flowered, slightly to distinctly overtopping the leaves; peduncles to ca. 15 mm long. FLOWERS: sepals ovate to elliptic-lanceolate, 5-8 mm long, persistent beyond capsule dehiscence, equaling or exceeding mature capsules; petals obovate, 9-16 mm long, light rose to purplish-red; stamens usually 20 or more; stigma 1, subcapitate. CAPSULES ellipsoid, 4-6 mm long. SEEDS smooth, ca. 1 mm long. [*Talinum brevicaule* S. Wats.; *T. pulchellum* Wooton & Standl.]. — Dry woodlands on rocky canyon slopes: mts of sw Cochise Co.; ca. 1900 m (ca. 6200 ft); May-Sep; NM, w TX; Chih., Coah., Mex.

Phemeranthus brevifolius (Torr.) Her shk. (short-leaved). —Herbs to ca. 6 cm tall. ROOTS elongate, woody. STEMS branching, spreading-ascending, sometimes suffrutescent. LEAVES crowded, sessile, to 15 mm long, subterete, linear to spatulate. INFLORESCENCE terminal cymules, sometimes on very short sub-branches and appearing lateral, often only 1-flowered, usually slightly overtopping the leaves; peduncles to ca. 3 mm long, sometimes obsolete. FLOWERS: sepals oval to orbiculate, 3-4 mm long, deciduous; petals obovate, 8-10 mm long, rose, lavender, or rarely white; stamens ca. 20; stigmas 3, sublinear. CAPSULES subglobose, 3.5-4 mm long. SEEDS smooth, ca. 1 mm long. [*Talinum brevifolium* Torr.]. —Dry rocky slopes and ledges in sand pockets: Apache, Coconino, Navajo cos.; 1600-2150 m (5200-7000 ft); Jun-Sep; NM, UT.

Phemeranthus humilis (Greene) Kiger (low-growing). —Herbs to 8 cm tall. ROOTS tuberous, sometimes forked. STEMS usually simple, erect overall, very short. LEAVES congested, sessile, terete, to 8 cm long. INFLORESCENCE lateral or terminal cymes, erect, overtopped by leaves; peduncles scape-like. FLOWERS: sepals ovate, ca. 3 mm long, deciduous; petals elliptic to obovate, ca. 4 mm long, yellow; stamens usually 5-8; stigma 1, subcapitate. CAPSULES ellipsoid to subglobose, sometimes triquetrous, 4-6 mm long. SEEDS with arcuate ridges on sides, ca. 1 mm long. [*Talinum humile* Greene]. —Dry shallow soil on or near rock outcrops: Santa Cruz Co.; ca. 1600 m (ca. 5200 ft); Jul-Aug; sw NM; Chih., D.F., Dgo., Mex.

Phemeranthus marginatus (Greene) Kiger ([leaves] margined). —Herbs to 5 cm tall. ROOTS tuberous. STEMS simple, erect overall, very short. LEAVES congested, strongly contracted at or below middle and appearing petiolate, to 4 cm long; distal portion flattened, oblong-spatulate. INFLORESCENCE lateral or terminal cymes, erect, usually overtopping the leaves; peduncles scape-like. FLOWERS: sepals broadly lanceolate to ovate, 2-3 mm long, deciduous; petals obovate 3-5 mm long, yellow; stamens 5; stigma 1, subcapitate. CAPSULES ellipsoid, ca. 3 mm long. SEEDS with arcuate ridges on sides, ca. 1 mm long. [*Talinum marginatum* Greene]. —Dry, rocky slopes, ridges and ledges: Cochise, Santa Cruz cos.; 1600-2150 m (5200-7000 ft.); Jul-Aug; Chih., Dgo., Nay., Son., Mex.

Phemeranthus parviflorus (Nutt.) Kiger (small-flowered). —Herbs to 2 dm tall. ROOTS elongate, becoming stout, somewhat woody. STEMS simple or branching, more or less erect, sometimes suffrutescent. LEAVES usually congested, sessile, terete, to 5 cm long. INFLORESCENCE lateral or terminal cymes, erect, greatly overtopping the leaves; peduncles scape-like. FLOWERS: sepals ovate, sometimes acuminate-cornate, 2.5-4.5 mm long, deciduous or sometimes persistent beyond capsule dehiscence and slightly shorter than mature capsule; petals obovate to elliptic, 5-7 mm long, pink to purple; stamens (4-)5(-6); stigma 1, subcapitate. CAPSULES ellipsoid or sometimes ovoid, sometimes obtusely triquetrous, 3.5-5 mm long. SEEDS smooth, ca. 1 mm long. [*Talinum confertiflorum*

Greene; *T. gooddingii* P. Wilson; *T. parviflorum* Nutt.]. —Dry woodlands, chaparral, scrub and grassland, on outcrops and in rocky soil; all counties except Graham, La Paz, Maricopa, Pinal, Yuma; 1200-2400 m (4000-7800 ft); Jun-Sep; AL, & MN, w to NM & WY; Chih., Coah., Mex. Varying considerable over its wide range. Plants from AZ with stems slender and tending to elongate, sepals apically cornate, and capsules ovoid have been recognized as *T. gooddingii* but intermediates of all degrees are found.

Phemeranthus validulus (Greene) Kiger (diminutively robust). —Herbs to 12 cm tall. ROOTS elongate, becoming stout, woody. STEMS branching, spreading-ascending overall, sometimes basally decumbent. LEAVES somewhat congested, sessile, terete, to 45 mm long. INFLORESCENCE lateral or terminal cymes, erect, slightly to greatly overtopping the leaves; peduncles to 6 cm long, sometimes scape-like. FLOWERS: sepals broadly lanceolate, 4 mm long, persistent beyond capsule dehiscence, shorter than mature capsules; petals elliptic-ovate, ca. 9 mm long, purplish pink, paler at base; stamens (7-)10-18; stigma 1, subcapitate. CAPSULES ovoid, strongly triquetrous, 5-7 mm long. SEEDS smooth, ca. 1 mm long. [*Talinum validulum* Greene]. —Woodland openings in rocky soil: Coconino, Mohave, Yavapai cos.; 1700-2300 m (5600-7500 ft); May-Sep.

Portulaca L. Purslane

Daniela Roth

Annual or perennial herbs. STEMS prostrate to ascending or erect. LEAVES alternate to subopposite, short-petioled or sessile, flat, cylindrical, subterete, linear or spatulate; margins entire; hairy nodes present or absent. INFLORESCENCE typically a cyme subtended by involucre leaves with flowers crowded at the branch ends or rarely solitary. FLOWERS perfect; sepals 2, united below, deciduous with the top of the capsule; petals mostly 5; ovary partly or wholly inferior; stamens 5 to many; stigmatic branches 2-9. CAPSULE membranaceous, circumscissile. SEEDS numerous, round-reniform, tuberculate, gray, brown, or black, often iridescent. —Ca. 125 spp. worldwide, mostly in the tropics and subtropics. (*portula*, latin for little door, referring to lid of capsule).

1. Lower portion of capsule with an expanded circular membranaceous wing just below the rim.....*P. umbraticola*
- 1' Lower portion of capsule without membranaceous wing.
 2. Leaf nodes and inflorescence glabrous or with inconspicuous hairs; leaves flat, obovate-cuneate or spatulate, typically more than 3 mm wide*P. oleracea*
 - 2' Leaf nodes and inflorescence with conspicuous hairs; leaves terete to subterete, typically less than 3 mm wide.
 3. Petals pink to purple.....*P. pilosa*
 3. Petals yellow, orange or copper.
 4. Plants perennial, erect; petals 3 – 10 mm long; capsules 2 – 4.2 mm in diameter.....*P. suffrutescens*
 4. Plants annual, prostrate to suberect; petals 2 – 2.5 mm long; capsules 1 – 2 mm in diameter*P. halimoides*

Portulaca halimoides L. (possibly referring to similarity with *Halimione*, an old name for *Atriplex*). Dwarf Purslane. —Annual herbs from a slender, fibrous root. STEMS much branched, prostrate to somewhat ascending, 2-16 cm long, often reddish, glabrous. LEAVES

alternate, linear, cylindrical or nearly so, 4-15 (18) mm long, 0.5-3 mm wide; nodes with conspicuous white-villous hairs. INFLORESCENCE white-villous; involucre bracts 6-8, 3-8 mm long, 0.5-3 mm wide. FLOWERS solitary or clustered at the ends of branches; sepals typically turning reddish at maturity; petals 2-2.5 mm long, yellow to copper colored; stigmatic branches 3-4. CAPSULE 1-2 mm in diameter; stipe 1-1.5 mm long. SEEDS iridescent grayish or blackish at maturity, rounded or stellate-tuberculate. [*Portulaca parvula* A. Gray]. —Sandy or gravelly soils, in open or brushy sites, often in disturbed places: Cochise, Coconino, Graham, Greenlee, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma cos.; 350-2050 m (1100-6800 ft); Mar–Nov; MO to CO; s to TX and NM.

***Portulaca oleracea* L.** (kitchen or pot herb). Common Purslane. —Annual herbs from a taproot. STEMS prostrate to somewhat ascending with radially spreading branches, 4-25 cm long or more often reddish, glabrous. LEAVES alternate, flat, ovate-cuneate or spatulate, 10-17 mm long, 5-12 mm wide; nodes with a few inconspicuous hairs in the axils. INFLORESCENCE glabrous or with a few inconspicuous hairs; involucre leaves 1-4, 6-20 mm long, 2-8 mm wide. FLOWERS solitary or clustered at the ends of branches; petals yellowish, 2-5 mm long; stigmatic branches 3-6. CAPSULE 2-6 mm in diameter; slightly stipitate. SEEDS black, finely granulate, stellate, or rounded-tuberculate. [*Portulaca retusa* Engelm.; *P. neglecta* Mack. & Bush]. —Disturbed areas, especially roadsides: reported from all AZ cos. except LaPaz; 450 – 2400 m (1400 – 7800 ft); Jun–Oct. Introduced. Worldwide in temperate to warm regions; throughout the U.S. (including AK) and Canada. Young leaves and stems edible raw or cooked. *Portulaca retusa* has been previously recognized as a separate species, based on seed morphological characteristics, growth habit, sepal shape, and number of stigmatic branches (Correll & Johnston 1970, W.B. McDougall 1973, Martin & Hutchins 2001, Kearney & Peebles 1960, Welsh et. al. 2003). Positive identification from herbarium specimens is only possible with mature seeds (rounded-tuberculate vs. sharply echinate or stellate in *P. retusa*). Intergradation of seed morphological characteristics between the two species has also been observed. Other characteristics such as growth habit, sepal shape, and number of style lobes, previously thought to distinguish *P. retusa* from *P. oleracea*, have been found highly variable (Correll & Johnston 1970, Martin & Hutchins 2001, Kearney & Peebles 1960, Welsh et. al. 2003, W.B. McDougall 1973). More work, especially with fresh intact specimens, is needed to substantiate recognition of *P. retusa* at the specific level.

***Portulaca pilosa* L.** ([nodes] with long soft hairs). Kiss Me Quick. —Annual or weakly perennial herbs from a fibrous root. STEMS prostrate to somewhat ascending, much branched, 3-16 cm long. LEAVES alternate, linear, cylindrical or nearly so, 3-13 mm long, 0.5-1.5 mm wide; nodes with conspicuous white-villous hairs. INFLORESCENCE white-villous; involucre leaves 6-10, 5-12 mm long, 0.5-1 mm wide. FLOWERS solitary or clustered at the ends of branches; petals reddish pink, 3-7 mm long; stigmatic branches 3-5. CAPSULES 2-5 mm in diameter; slightly stipitate. SEEDS black, stellate-tuberculate. [*Portulaca mundula* I.M. Johnst.]. —Gravelly or sandy soils, slopes and dry washes: Cochise, Santa Cruz, Yavapai cos.; 1200-1600 m (4000-5200 ft); Apr–Sep; MO to KS, TX, CA, NM, n Mex.

Portulaca pilosa can be confused with *P. suffrutescens* when not in flower. *P. suffrutescens* is stiffly erect while *P. pilosa* tends to be prostrate or only somewhat ascending. Also, the distance between leaf nodes in *P. suffrutescens* is generally longer than in *P. pilosa*.

(5-25 mm vs. 1-7 mm). The density of hairs in the nodes gives *P. pilosa* a more hairy appearance and the involucre hairs are whitish rather than tan or brownish. Some of these characteristics might not be apparent in young plants, plants grown under difficult conditions, or herbarium specimens.

Portulaca suffrutescens Engelm. (slightly woody). Shrubby Purslane. —Perennial herb from tuberous thickened rootstocks. STEMS erect or ascending 10-23 cm high, somewhat suffrutescent. LEAVES alternate, sometimes subopposite, the blades cylindrical, linear, 7-20 mm long, 0.5-1.5 mm wide; nodes with long hairs. INFLORESCENCE villous with conspicuous, mostly tan or brownish hairs; involucre leaves 6-10, 6-30 mm long, 0.5-2 mm wide. FLOWERS clustered at the ends of branches; petals orange or copper colored, 3-10 mm long; stigmatic branches 5-6. CAPSULE 2-4.5 mm in diameter; stipe to 1 mm long. SEEDS black, sometimes iridescent, rounded-tuberculate. [*Portulaca stelliformis* Moc. & Sesse ex DC.]. —Rocky slopes, flats, grasslands, roadsides, disturbed places, and in sandy, gravelly places along streams: Cochise, Gila, Graham, Pima, Pinal, Santa Cruz, Yavapai cos.; 600-1850 m (2000-6000 ft); May-Sep; NM, TX; n Mex.

Portulaca umbraticola Kunth (shade-dwelling). Wingpod Purslane. —Annual herbs with a fibrous root. STEMS prostrate to erect or ascending, 4-20 cm long, glabrous. LEAVES few, mostly alternate, sometimes subopposite, flat, lanceolate or spatulate, 10-35 mm long, 2-15 mm wide, glabrous; nodes sometimes with a few inconspicuous hairs. INFLORESCENCE glabrous, with 4-5 conspicuous involucre leaves, 10-30 mm long, 1-7 mm wide. FLOWERS clustered at the ends of branches; petals pink, purple, yellow or orange tipped with red, 5-10 mm long; stigmatic branches 5-18. CAPSULE 3-5 mm in diameter with an expanded circular membranaceous wing just below the rim; stipe 1-1.5 mm long. SEEDS gray, tuberculate. AZ to NC, s to TX; S. Amer.

Subsp. ***lanceolata*** J.F. Matthews & Ketron. (lance-shaped [leaves]). —Flower diameter 8-15 mm; petals bi-colored. [*P. lanceolata* J.F. Matthews & Ketron]. —Dry sandy or rocky soils, desert grasslands, oak woodlands, wash bottoms, disturbed sites: Cochise, Gila, Graham, Pima, Santa Cruz cos.; 900-1850 m (3000-6000 ft). Jun-Oct. NM e to AR, LA.

Talinum Adanson

Robert W. Kiger

Perennial herbs, caulescent, sometimes suffrutescent, glabrous. ROOTS fleshy to woody. STEMS simple or branching. LEAVES alternate or subopposite, subsessile or short-petiolate; blades broadly planate, succulent or semi-succulent; margin entire. INFLORESCENCE in ours terminal and/or lateral panicles; peduncles very short to elongate. FLOWERS pedicellate; sepals 2, deciduous, distinct; petals 5 or rarely more, distinct, fugacious; stamens distinct; ovary superior, 3-carpellate; ovules many; placentation free-central; style 1; stigmas 3, linear in ours. CAPSULE tardily loculicidal from the apex, 3-valved, the exocarp and endocarp macroscopically differentiated and separating after dehiscence, the endocarp valves remaining connate at apex, attached to receptacle by vascular strands from capsule apex, persistent, the exocarp valves deciduous separately. SEEDS many, small, in ours circular reniform and more or less compressed, minutely tuberculate, black, not covered by membrane. $x = 12$. —Ca. 15 spp., primarily Amer., Afr. (Apparently from an African vernacular name.)

Talinum paniculatum (Jacq.) Gaertn. (with panicles). Pink baby breath. —Herbs to 1 m tall. ROOTS tuberous. STEMS erect. LEAVES short-petiolate; blades elliptic to obovate, basally attenuate, to 12 cm long, reduced upward. INFLORESCENCE spreading, to 25 cm long. FLOWERS: sepals ovate to suborbiculate, 2.5-4 mm long, sometimes reflexed; petals ovate to suborbiculate, 3-5 mm long, red or pink, sometimes orangish, yellowish, or purplish; stamens ca. 15-20; stigmas 3, linear. CAPSULES subglobose, sometimes obtusely triquetrous, 3-5 mm long. SEEDS ca. 1 mm long. [*Talinum patens* (L.) Willd.]. —Moist to dry habitats in woodlands and savannas, also desert scrub and grasslands, in rocky soil and crevices, in open and often in shade: Cochise, Greenlee, Pima, Santa Cruz cos.; 750-1600 m (2500-5200 ft); Jul-Oct; NC to FL, w through NM; Chih., Coah., Son., Mex. s to Argentina.

ACKNOWLEDGEMENTS

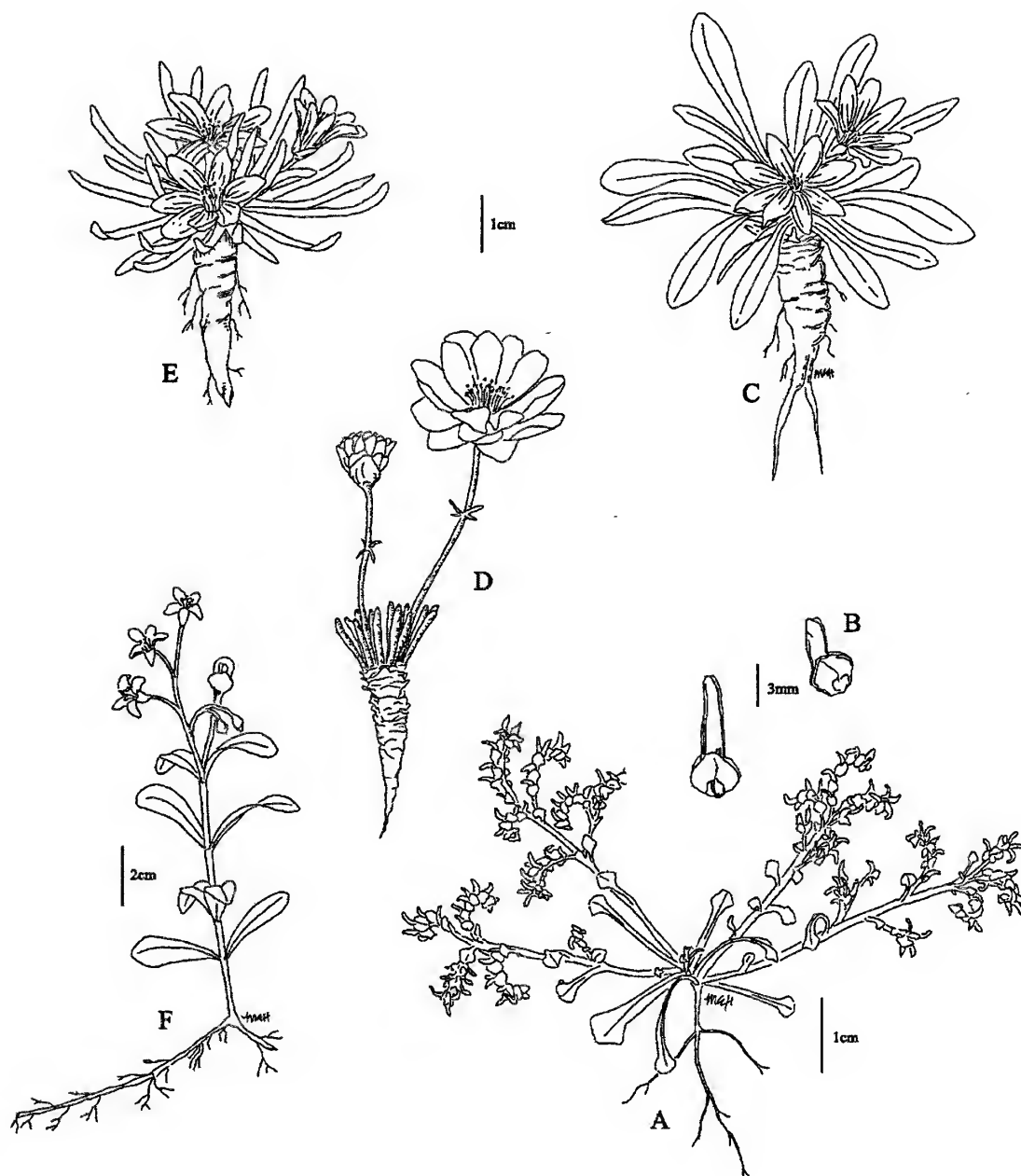
We thank the following herbaria for the use of their specimens: AA, ARIZ, ASC, ASU, CLEMS, CM, DES, GH, K, MNA, MO, NMC, NO, RM, TEX, and US. Maps were modified using the specimen data available on SEINet (<http://seinet.asu.edu/>). Mar-Elise Hill drew the original illustrations and H. David Hammond reviewed the treatment. Max Licher provided the digital images used to make figure 9. David Edwards and Kirsten Aamodt provided technical assistance with Adobe Photoshop.

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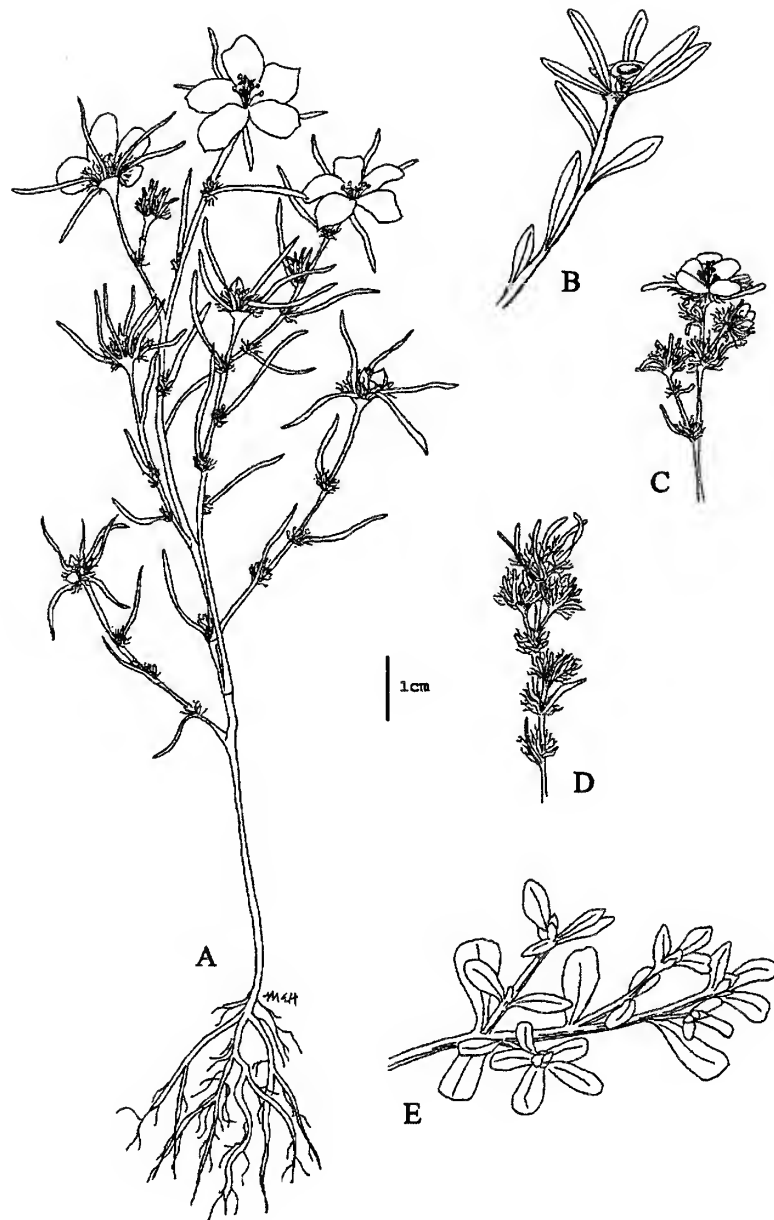
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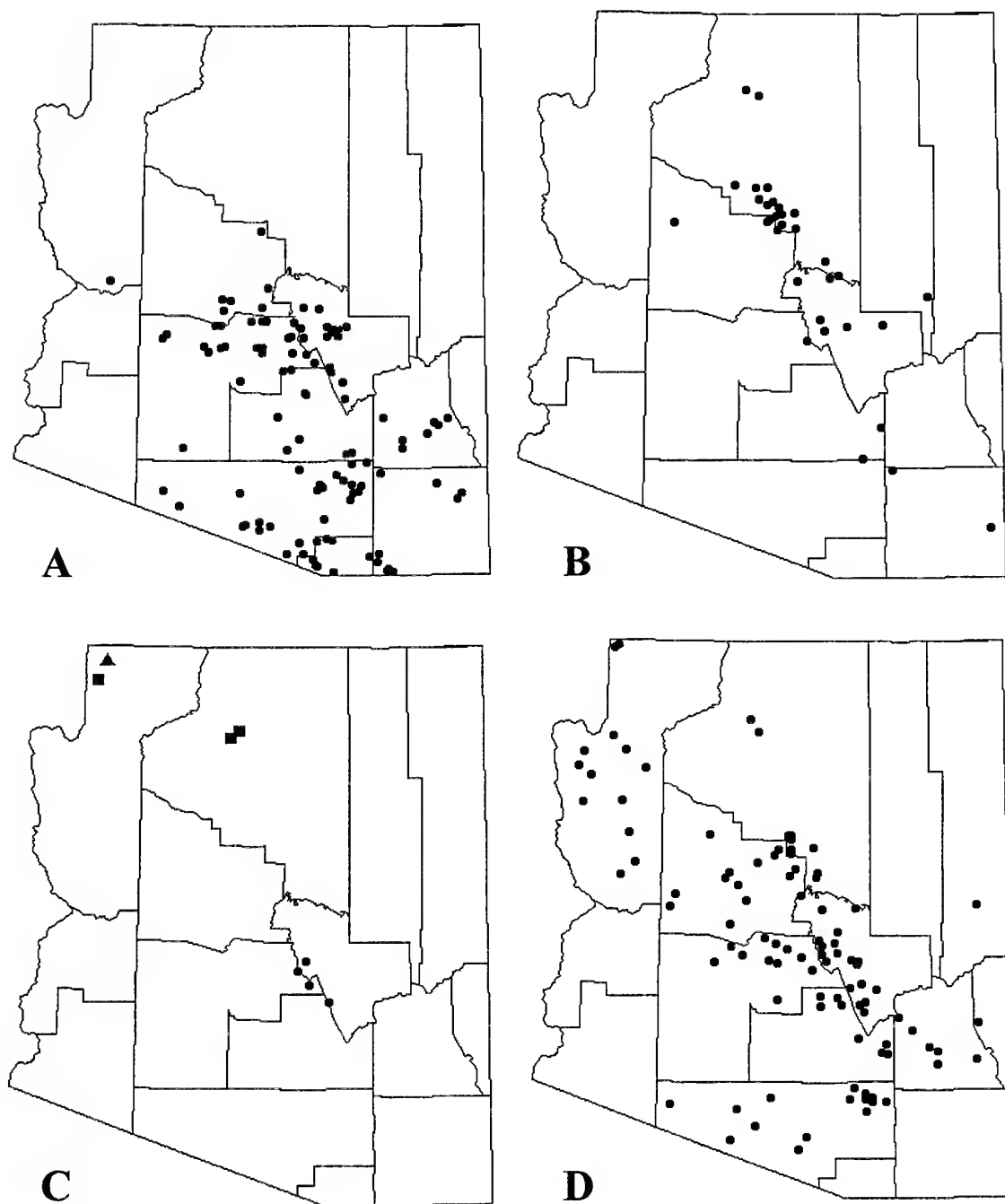
Portulacaceae Fig. 1. A, *Calandrinia ciliata*, habit, flower, leaf; B, *Claytonia lanceolata* var. *rosea*, habit; C, *Claytonia parviflora* subsp. *viridis*, habit; D, *Claytonia perfoliata*, habit, leaf.



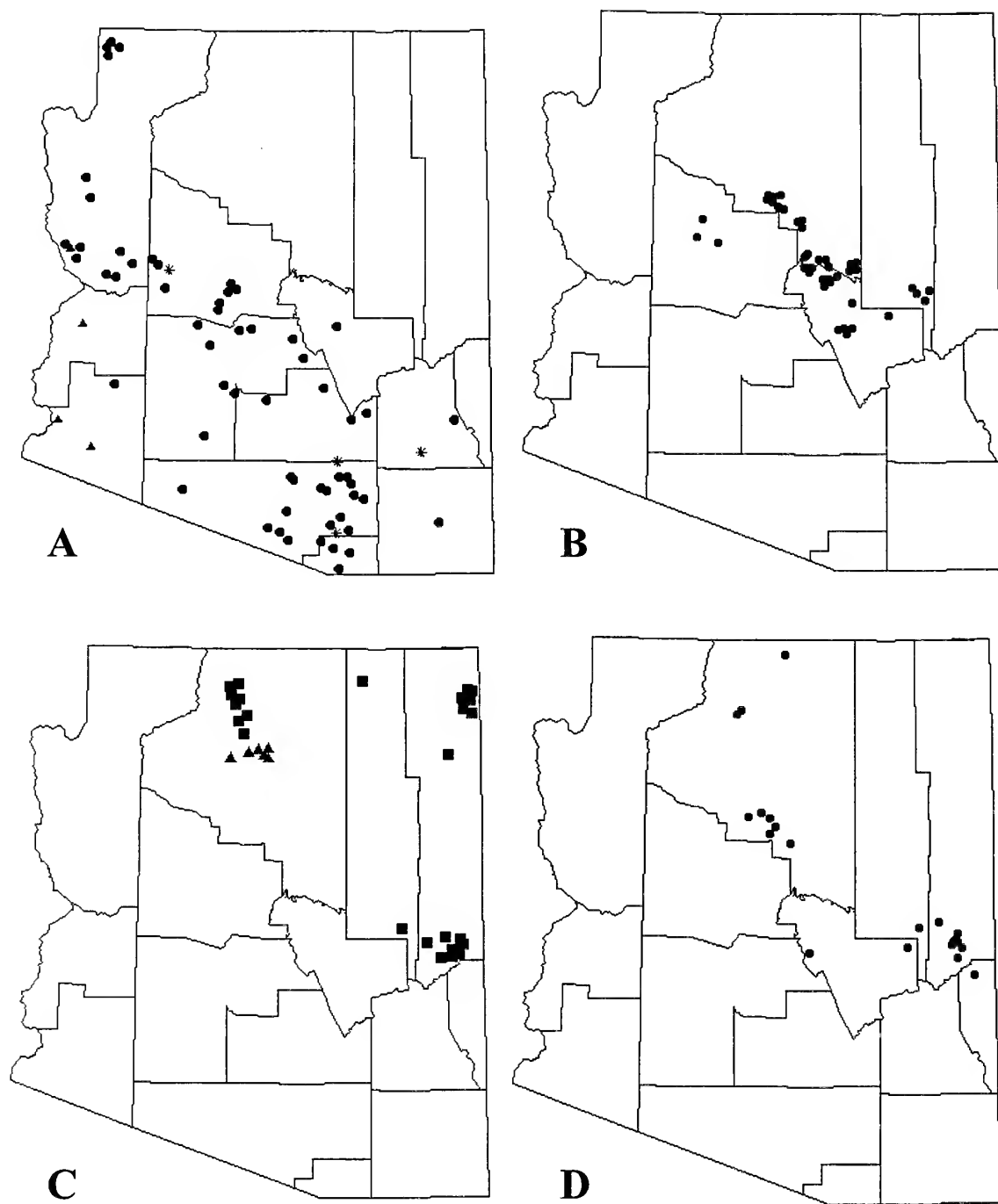
Portulacaceae Fig. 2. A, *Cistanthe monandra*, habit, fruit enclosed in sepals; B, *Cistanthe parryi*, fruit enclosed in sepals; C, *Lewisia brachycalyx*, habit; D, *Lewisia rediviva*, habit reconstruction showing leaves present with flowers; E, *Lewisia pygmaea*, habit; F, *Montia chamissoi*, habit.



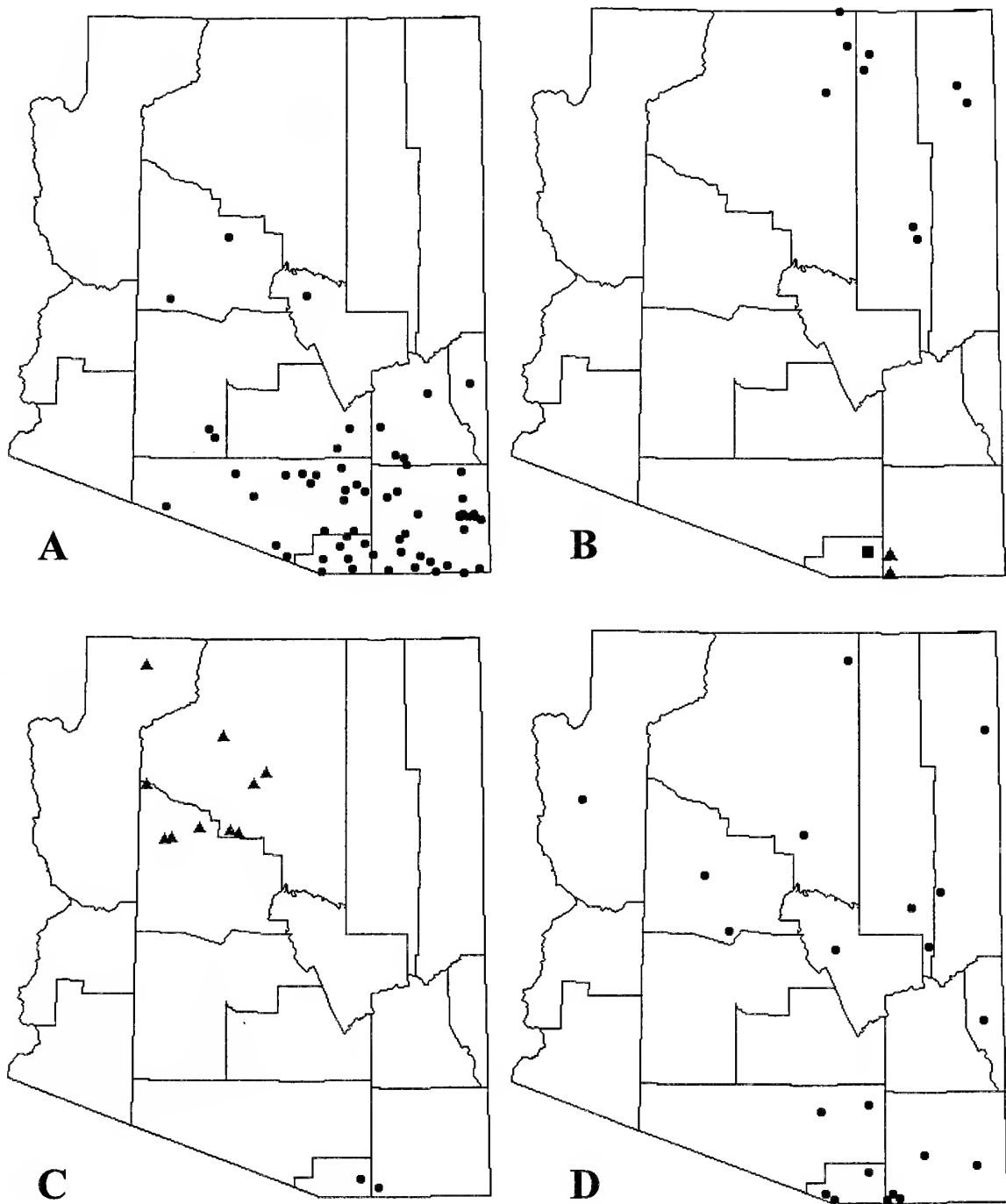
Portulacaceae Fig. 3. *Portulaca*. A, *P. suffrutescens*, habit; B, *P. umbraticola*, flowering stem; C, *P. pilosa*, flowering stem; D, *P. halimoides*, flowering stem; E, *P. oleracea*, flowering stem.



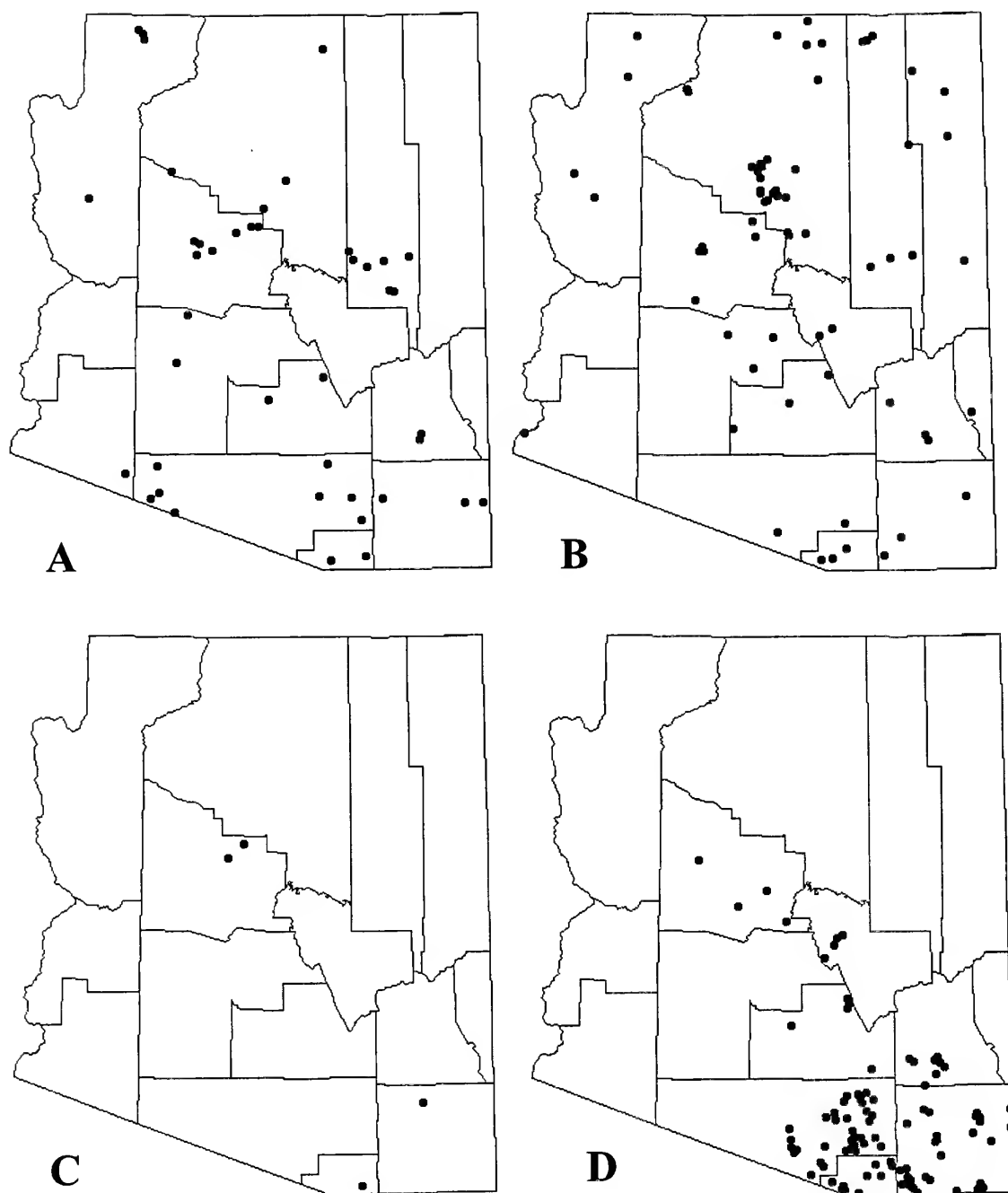
Portulacaceae Fig. 4. Distributions of: A, *Calandrinia ciliata*; B, *Claytonia lanceolata* var. *rosea*; C, *Claytonia parviflora* subsp. *parviflora* (●), subsp. *utahensis* (■), subsp. *viridis* (▲); D, *Claytonia perfoliata*.



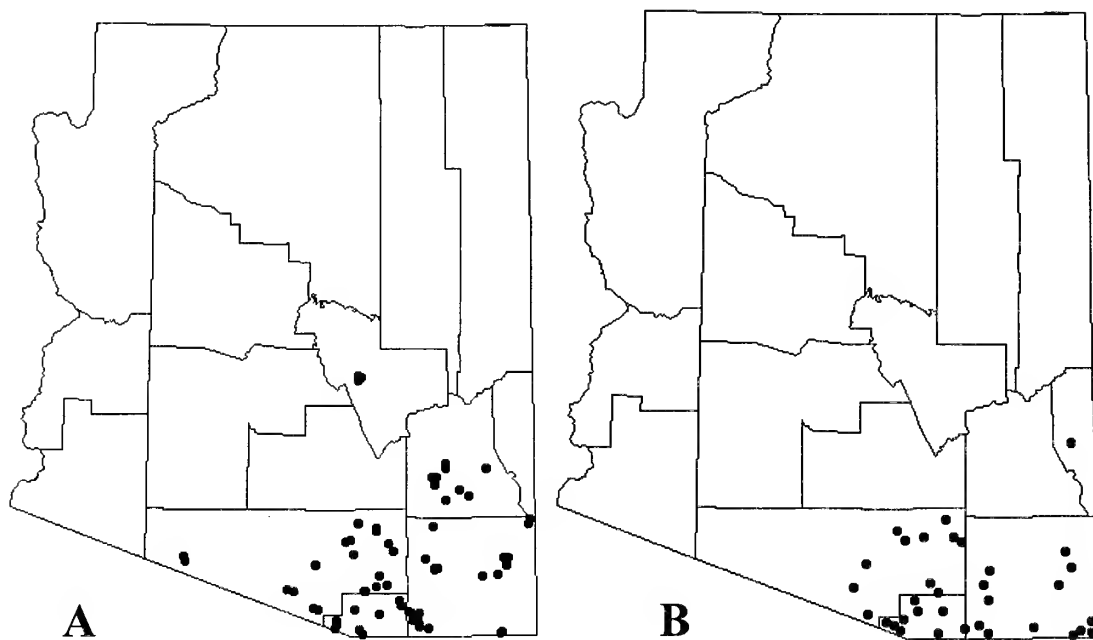
Portulacaceae Fig. 5. Distributions of: A, *Cistanthe ambigua* (▲), *C. monandra* (●), *C. parryi* (*); B, *Lewisia brachycalyx* (●); C, *L. pygmaea* (■), *L. rediviva* (▲); D, *Montia chamissoi*.



Portulacaceae Fig. 6. Distributions of *Phemeranthus*: A, *P. aurantiacus*; B, *P. brevicaulis* (▲), *P. brevifolius* (●), *P. humilis* (■); C, *P. marginatus* (●), *P. validulus* (▲); D, *P. parviflorus*.



Portulacaceae Fig. 7. Distributions of *Portulaca*: A, *P. halimoides*; B, *P. oleracea*; C, *P. pilosa*; D, *P. suffrutescens*.



Portulacaceae Fig. 8. Distributions of: A, *Portulaca umbraticola*; B, *Talinum paniculatum*.



Portulacaceae Fig. 9. A, *Cistanthe monandra* habit. B, *Cistanthe monandra* fruit. C, *Calandrinia ciliata*. D, *Claytonia parviflora*. E, *Claytonia perfoliata*. F, *Claytonia lanceolata* var. *rosea*. G, *Lewisia brachycalyx*. H, *Phemeranthus aurantiacus*. I, *Phemeranthus parviflorus*. J, *Portulaca halimoides*. K, *Portulaca oleracea*. L, *Portulaca suffrutescens*. Photos by Max Licher.

RHAMNACEAE BUCKTHORN FAMILY

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Shrubs or small trees, unarmed or armed, with perfect flowers or less often monoecious. LEAVES alternate, subopposite or opposite, solitary or fascicled, simple, deciduous or evergreen; stipules present; bud scales present or absent. INFLORESCENCES of terminal or axillary cymose clusters. FLOWERS actinomorphic, perfect or imperfect; sepals 4-5, triangular, deciduous or persistent (in *Colubrina californica*); petals (0-) 4-5, free, usually concave or hooded, clawed; stamens 4-5, in 1 whorl, opposite the petals and often enshrouded by them; filaments adnate to petals; nectar-disc well-developed; ovary superior or partially inferior, of 2-3 united carpels; placentation basal; style entire, lobed, or deeply cleft; ovules basal, 1 or 2 per locule. FRUITS capsules or drupes with 1-3 stones, these 1(-2)-seeded. SEEDS sometimes with a dorsal groove. Ca. 50 genera, 875 spp., cosmopolitan but mainly tropical and subtropical.

Rhamnus catharticus L. has been used as a potent purgative. Some AZ species are used medicinally by Southwestern Native Americans (Moerman 1998).

1. Plants with conspicuous thorns.
 2. Plants essentially leafless; of extreme se Cochise Co. *Adolphia*
 - 2' Plants leafy.
 3. Leaves prominently palmately 3-veined from leaf base *Ceanothus* (in part)
 - 3' Leaves pinnately-veined or veins obscure.
 4. Leaves opposite *Ceanothus* (*C. vestitus*)
 - 4' Leaves alternate.
 5. Leaves of short shoots crowded, often in clusters; petals absent; fruit beaked *Condalia*
 - 5' Leaves of short shoots sparse, usually solitary; petals present; fruit not beaked *Ziziphus*
 - 1' Plants without thorns or thorns inconspicuous.
 6. Leaves prominently palmately 3-veined from leaf base *Ceanothus* (in part)
 - 6' Leaves pinnately veined or veins obscure.
 7. Leaves opposite or subopposite.
 8. Leaves thick, dull green; flowers showy conspicuous; perianth white to blue or lavender; fruit a capsule *Ceanothus* (*C. vestitus*)
 - 8' Leaves thin, shiny, bright green; flowers inconspicuous; perianth yellowish-green or cream; fruit a drupe *Sageretia*
 - 7' Leaves alternate or fascicled.
 9. Fruit a capsule; leaves 0.4-1.7 (3.5) cm long; plants of La Paz, Yuma, Maricopa, and Pinal cos. *Colubrina*
 - 9' Fruit a drupe; leaves 2-14 cm long or if less than 2 cm long then confined to Pima Co. (*Rhamnus crocea*).

10. Flowers 4-merous, imperfect; stigma branched; seeds grooved; bud scales present; leaves 0.7-6 cm long.....*Rhamnus*
 10' Flowers 5-merous, perfect; stigma lobed; seeds smooth; bud scales absent; leaves 2.8-14 cm long.....*Frangula*

Adolphia Meisn. Junco

Kyle Christie

Shrubs, armed. STEMS several to many, erect to ascending, green, rigid; branches mostly opposite, jointed, thorn-tipped, villous when young, glabrescent with age; bud-scales absent. LEAVES early deciduous, opposite, subopposite, or fascicled, short-petiolate; blades lanceolate to ovate, pinnately veined, entire, sparsely to densely villous.

INFLORESCENCES axillary, cymose, of several flowers. FLOWERS perfect, pedicellate; hypanthium hemispheric, 2-3 mm in diameter, slightly villous; sepals 5, triangular, whitish and petaloid; petals 5; stamens 5; ovary superior; stigma obscurely 3-parted. FRUITS dry, loculicidal capsules, 3-loculed, tan, spheric, 5 mm long, 5 mm wide, beaked by a persistent style, glabrous; seeds 3, 1 per locule, plano-convex. —2 spp. in the Southwestern U.S. and Mex. (1 in AZ). (named for Adolphe Brongniart, Rhamnaceae taxonomist, 1801-1876). An essentially leafless plant with photosynthetic stems. Both species are seemingly rare.

Adolphia infesta (Kunth) Meisn. (dangerous). Junco, Texas Adolphia. —Shrub, erect, 0.5-2 m tall. STEMS with somewhat slender, spreading, lateral branches. Thorns up to 6 cm long. LEAVES with decurrent whitish petioles less than 2 mm long; blades narrowly oblanceolate to linear, 3-10 mm long, 1-3 mm wide, villous to glabrous, light green; apices mucronate; bases tapering. INFLORESCENCES of 1-4 flowers; pedicels 4-7 mm long. — Open slopes and washes: extreme se AZ in the vicinity of Guadalupe Canyon, Cochise Co.; 1200-1500 m (4000-5000 ft.); flowering late spring and summer; s NM, s TX, and n Mex.

Adolphia infesta has an extremely narrow distribution in AZ. This description is based upon a single collection (*R.M. Turner & J.B. Turner 89-1*, ARIZ 285077, ASU 172509) from near the AZ-NM state border. Another specimen from NM, (*W.J. Hess 2432*, housed at MOR), has been collected in Guadalupe Canyon on the w side of the Peloncillo Mountains. Additional searches for *A. infesta* should be conducted throughout the area.

Ceanothus L.

Michael Currie and Tina Ayers

Shrubs, armed or unarmed. STEMS spreading to erect, green-brown to gray, pubescent to glabrous. LEAVES evergreen or deciduous, alternate or opposite, entire or dentate, acute to rounded, palmately to pinnately veined. INFLORESCENCES of cymose panicles.

FLOWERS perfect, pedicellate; sepals 5, white to light blue or purple; petals 5, 3-5 mm long, long-clawed, white to light blue or purple. FRUITS 3-chambered capsules, green maturing dark brown to black, globose, roughened; seeds 1 per chamber.

Ceanothus is prized as a honey plant, and is used medicinally and ceremonially by many native American tribes (Moerman 1998). Many species of *Ceanothus* have been cultivated as ornamentals, most commonly known as wild-lilac or mountain-lilac. —62 spp. in N. Amer. (4 in AZ).

1. Leaves opposite, pinnately veined.....*C. vestitus*
- 1' Leaves alternate, palmately 3-veined
 2. Leaves usually longer than 4 cm, glabrous above; inflorescence terminal on long branches, 5-25 cm long.....*C. integerrimus*
 - 2' Leaves 1-4 cm long, pubescent to glabrous above; inflorescence axillary and terminating short branches, usually not more than 4 cm long
 3. Plants with obvious thorns; leaves dark green above, often light green to whitish below *C. fendleri*
 - 3' Plants generally without thorns; leaves bright green above and below. *C. martinii*

Ceanothus fendleri A. Gray (for August Fendler, 1813-1883, NM naturalist). Fendler's Ceanothus. –Shrubs, armed, to 2 m tall. STEMS low, spreading to erect, pubescent, green-brown to gray; thorns 1-5 cm long, sometimes absent in young plants. LEAVES evergreen, alternate; petioles 2-4 mm long; blades oblanceolate to oblong, palmately veined, 0.8-3 cm long, 0.4–1.9 cm wide, palmately 3-veined, with margins entire, dark green above, light green to whitish below, pubescent to glabrous. INFLORESCENCES terminal or axillary, 3-10 flowers per cluster. FLOWERS white to light green. FRUITS 3-5 mm wide. [*C. fendleri* var. *venosus* Trelease]. –Open coniferous forest: Cochise, Coconino, Gila, Graham, Greenlee, Mohave, Navajo, Pima, Santa Cruz, Yavapai cos.; 1600-2800 m' (5300-9200 ft); Apr-Sep; SD s to WY, UT, CO, NM and TX ; Chih., Mex.

Plants with broadly elliptic to obovate, pubescent leaf blades from s AZ have been recognized as *C. fendleri* var. *venosus* Trelease.

Ceanothus integerrimus Hook. & Arn. (undivided or entire). Deerbrush. – Shrubs, unarmed, 1 to 3 m tall. STEMS erect, green-brown to gray at maturity. LEAVES alternate, deciduous; petioles 1-2 cm long; blades broadly elliptic to ovate or oblong, 2-8 cm long, 1-5 cm wide, dark green above, light green below, often pubescent; margins entire. INFLORESCENCES of axillary clusters, 3-15 flowers per cluster, usually exceeding the leaves. FLOWERS white to dark blue. FRUITS 3-5 mm wide. 2-3 varieties; WA, OR, CA, AZ, NM; n Mex.

Var. **macrothyrsus** (Torrey) G. T. Benson (large-panicled). –Leaves palmately 3-veined from the base. –Chaparral, open coniferous forest: Cochise, Coconino, Graham, Mohave, Pima cos.; 914–2133 m (3500-7000 ft); Mar-May. CA, AZ, NM; n Mex.

Ceanothus martinii M. E. Jones (for Martin). –Shrubs to 1 m tall. STEMS widely spreading, pubescent, green-brown to gray. LEAVES deciduous, alternate; petioles 1-3 mm long; blades oval to elliptic or obovate, 1-2.5 cm long, 0.5-1.9 wide, palmately 3-veined, bright green above and below, mostly glabrous, pubescent along veins; margins entire. INFLORESCENCES of axillary clusters, 3-10 flowers per cluster. FLOWERS white. FRUITS 3-5 mm wide. –Open coniferous forest: Coconino, Mohave cos.; 1600-3100 m (5200-10000 ft); Apr-Sep; WY, UT, CO, NV.

Ceanothus vestitus E. L. Greene (covered, clothed in hairs) Mohave Ceanothus. – Shrubs to 2 m tall. STEMS erect, greenbrown to gray, tomentose to glabrous at maturity. LEAVES evergreen, opposite; petioles 1-3 mm long; blades elliptic to obovate, pinnately veined, 0.6-1.9 cm long, 0.5-1 cm wide, gray-green, pilose to glabrate; margins entire to spinose-dentate. INFLORESCENCES axillary, 3-10 flowers per cluster, usually not exceeding the leaves. FLOWERS often white, sometimes blue to purple. FRUITS 3-5 mm wide. [*C. greggii* A. Gray var. *vestitus* (E. L. Greene) McMinn; *C. greggii* A. Gray var.

orbicularis E.H. Kelso] –Desert mountains, chaparral: Coconino, Cochise, Gila, Graham, La Paz, Mohave, Pima, Mohave, Yavapai cos.; 900-2100m (3000-6900ft); Mar-May. CA, NM, NV, UT, sw TX; n Mex.

McVaugh (1998) presents evidence that *Ceanothus greggii* A. Gray cannot be recognized as it is a later heterotypic synonym of *C. pauciflorus* DeCandolle. Furthermore AZ populations of this complex apparently all belong to *C. vestitus*.

Some authorities list *Ceanothus greggii* var. *greggii* (now correctly referred to as *C. pauciflorus*) and *C. greggii* var. *perplexans* (now correctly named *C. perplexans*) as occurring in AZ. *Ceanothus pauciflorus* occurs broadly in n Mex. from Son., Chih., Coah. and N. L. s to Tamps. and S. L. P. It can be recognized by convex or flat upper leaf surfaces, tomentulose lower leaf surfaces, and thick to revolute margins. Typical *Ceanothus perplexans* is restricted to the Peninsular Ranges of CA s to Baja C., Mex. and can be recognized by broadly obovate to orbicular leaf blades that are usually flat with 5-11 weakly spinulose teeth on the margins. Recognition of either *C. pauciflorus* or *C. perplexans* in AZ or documentation of possible introgression with *C. vestitus* must await a thorough revision of this entire group.

Colubrina Rich.

Laura Smith Davis

Shrubs, ours weakly armed. STEMS several to many, intricately branched, widely spreading; branches alternate or opposite; twigs woolly to glabrous with age. LEAVES evergreen or deciduous, alternate or fascicled, petiolate; blades elliptic to oblong or ovate to obovate, pinnately-veined, entire to serrate, sparsely pubescent. INFLORESCENCES axillary clusters. FLOWERS perfect, pedicellate; hypanthium hemispheric; sepals triangular; petals 5; stamens 5, ovary less than to one third inferior; style 3-lobed. FRUITS capsules, 3-loculed; seeds 3, 1 per locule. –31 spp. worldwide (1 in AZ), especially in warm places. (*Coluber*; an ancient Latin name meaning snake-like).

Colubrina californica I. M. Johnst. California Colubrina. –Shrub, 1.0-2 (-3) m tall; branches widely spreading. STEMS weakly armed or unarmed, alternate; bark reddish brown, gray to whitish, covered with dense, matted, wool-like hairs, becoming less so with age. LEAVES deciduous, alternate or fascicled; stipules triangular; petiole 0.5-4 mm long, woolly; blades 4-17 (-35) mm long, 4-11 (-20) mm wide, dull gray-green to yellowish-green, pubescent, entire or occasionally with 1 or 2 teeth. INFLORESCENCES of (1-) 2-12 flowers, dense; pedicels 1-1.5 mm long. FLOWERS inconspicuous; hypanthium 2.0-2.5 mm wide, woolly; sepals 1 mm long, light green; petals ca. 1 mm long, yellowish, green. FRUITS persistent, woody, three-lobed, dark purple to black capsules, 6-9 mm long, 7-8.5 mm broad, with persistent sepals; pedicels becoming woody and stouter in fruit. [*Colubrina texensis* (Torr. & A. Gray) A. Gray var. *californica* (I. M. Johnst.) L. D. Benson]. –Along washes and dry slopes: La Paz, Maricopa, Pinal and Yuma cos.; 500-1000 m (1500 –3000 ft); spring and summer; se CA; Baja C, Mex.

Benson and Darrow noted that *Colubrina californica* is a relict of interest as it occurs in widely separated areas. (Benson and Darrow 1954).

Condalia Cav. Snakewood

Kyle Christie

Thorny shrubs or small trees. STEMS several to many, ascending; bark slightly furrowed to striated; branches alternate, the primary lateral branches thorn-tipped; twigs hispidulous; bud scales absent. LEAVES deciduous, alternate or fasciated in clusters of 2-8 on lateral short shoots, sessile to subsessile; blades spatulate to obovate, pinnately veined, with 2-3 pairs of lateral veins, entire, hispidulous. INFLORESCENCE axillary, cymose of 2-8 flowers, borne on lateral short shoots. FLOWERS perfect, sessile to pedicellate, inconspicuous; hypanthium hemispheric, 1-1.5 mm wide, hispidulous to glabrous; sepals 5, greenish outside, yellowish within, deltate, 1 mm long; apetalous, stamens 5; ovary superior; style entire. FRUIT a fleshy drupe, green, maturing to purple-black, globose or slightly elongate, glabrous to slightly pubescent; stones 1, smooth, distinctly beaked by a persistent style base, black to tan; seeds 1(-2). —18 species in the Americas. (named for the Spanish physician Antonio Condal, 1745-1804).

There has been debate about which *Condalia* species occur in AZ. Both regional floras and various herbarium collections have cited *C. ericoides*, *C. correllii*, *C. mexicana*, *C. globosa* var. *pubescens*, *C. spathulata*, and *C. warnockii* var. *kearneyana* as occurring in AZ.

Condalia can be broadly segregated into three groups based on leaf shape: a linear-leaved group, a broad-leaved group, and a spatulate-leaved group. *Condalia ericoides* (*Microrhamnus ericoides*) is quite unusual and can be identified by its light green, linear, revolute leaves; its distinctly football-shaped fruit; and its petal-bearing flowers. *Condalia ericoides* is primarily a Chihuahuan species that occurs in e NM, TX, and n Mex. The accounts of *C. ericoides* in AZ have arisen from misidentification and this species has not been vouchered within our range.

The broad-leaved *Condalia correllii* and *C. mexicana* are also cited as occurring in AZ. M. C. Johnston (1962) separates these species by nuances of leaf color and venation, a slight difference in fruit length, as well as by overlapping characters of leaf size. These distinct taxa are closely related; however only *C. correllii* occurs in AZ. Some floras have mistakenly cited *C. mexicana* as occurring in AZ or at least mistakenly used the name *C. mexicana* for AZ material, however this taxon does not occur in the state. *Condalia correllii* occurs in AZ in s Cochise and Santa Cruz cos., and in Pima Co. in the Baboquivari Mountains and Chimena Canyon of the Rincon Mountains.

Previous floristic treatments of the spatulate-leaved group of *Condalia* species have been problematic. M. C. Johnston separated *C. globosa*, *C. warnockii*, and *C. spathulata* based on characters of pedicel length, stone length to width ratio, internode length, leaf pubescence, and abaxial leaf venation. AZ specimens have been variously identified as all three of these species. *Condalia spathulata* has completely glabrous leaves and does not occur in AZ.

Condalia globosa and *C. warnockii* share various overlapping morphological characters, and these very characters have often been used to separate the two species. Previous difficulty in identification may have also stemmed from the quality of herbarium material. *Condalia* is usually densely and diffusely branched and almost impenetrable; however it is extremely important to collect mature branches of *Condalia*. Immature material often displays unusual traits, especially with respect to leaf venation. Traits of the abaxial leaf venation have been used to differentiate between these two species, however

venation is extremely variable as a result of environment and age. Characters of the abaxial leaf veins should not be used to differentiate between *C. globosa* and *C. warnockii*.

Condalia globosa and *C. warnockii* are very similar species and no single character readily separates the two. It is best to use a suite of character traits to identify these species. *C. globosa* has deciduous sepals, medium to long pedicels, usually cuneate leaf bases, often obtuse leaf apices, more or less smooth leaf surfaces (which are often yellow to orange beneath), a globose stone, and a bitter drupe. *C. warnockii* has persistent sepals, short to medium pedicels, attenuate leaf bases, usually acute leaf apices, distinctly wrinkled to slightly wrinkled leaf surfaces (which are not yellow to orange beneath), a somewhat elongate stone, and a less bitter drupe. The two species can overlap with respect to any of these characters, however they occur almost allopatrically. *C. globosa* generally inhabits the w portion of s AZ, whereas *C. warnockii* generally inhabits the e portion of s AZ. Both species occur in the Ajo area and in the Batomote Mountains east of Childs.

1. Flowers and fruits sessile or subsessile; leaves usually more than 4 mm wide, the abaxial leaf veins inconspicuous; plants somewhat openly branched; secondary branches distinctly thorned ***C. correllii***
- 1' Flowers and fruits pedicellate; leaves usually less than 4 mm wide, the abaxial leaf veins conspicuous; plants densely and diffusely branched; secondary branches usually suppressed.
 2. Sepals predominantly deciduous in fruit; stone more or less globose; pedicels usually 3-4 mm long; leaf bases attenuate to cuneate; apices usually obtuse to mucronate; leaf surface smooth; drupe quite bitter..... ***C. globosa***
 - 2' Sepals predominantly persistent in fruit; stone somewhat elongate; pedicels usually 1-2.5 mm long; leaf bases acute to sometimes attenuate; apices acute to occasionally obtuse; leaf surface slightly wrinkled; drupe not bitter or mildly bitter ***C. warnockii***

Condalia correllii M.C. Johnst. (honors D.S. Correll, Texas botanist, 1908-1983). Correll's Snakewood. –Openly branched, 1-2(-2.5) m tall, 1-1.5 m wide. STEMS several, bark light gray to whitish; primary lateral branches spreading to divergent; secondary lateral branches conspicuous as thorns. LEAVES obovate to oblanceolate, 8-16 mm long, 4-6 mm wide, acute to mucronate, bright green, slightly but distinctly wrinkled above, sparsely hispidulous, veins thin and inconspicuous; base acute. INFLORESCENCE borne on suppressed secondary shoots, usually 1-2 flowers reaching maturity per fascicle. FLOWERS sessile, or with pedicels less than 0.5 mm; sepals persistent. FRUIT not distinctly bitter, with the stone distinctly longer than wide, 5-7 mm long, 3-5 mm wide, brown to tan. –Dry slopes, drainages, canyons: s Cochise, s Santa Cruz, and Pima eos. (Baboquivari Mountains and Chimena Canyon); 1200-1500 m (4000-5000 ft); flowering Jul-Sep; AZ, NM, n Mex.

Condalia globosa I. M. Johnst. (globose). Bitter Condalia. –Diffusely branched, 1-4 m tall, 1-4 m wide. STEMS many; bark gray-brown; primary lateral branches spreading to ascending; secondary lateral branches suppressed. LEAVES spatulate or young leaves occasionally elliptic, (3-)5-13(-17) mm long, (1-)2-4(-5) mm wide, obtuse to mucronate or occasionally acute, with base cuneate to distinctly attenuate, dull green, smooth above, occasionally yellowish or orangish beneath, sparsely to densely hispidulous, veins thick and

prominent, becoming thinner and flattened with age. INFLORESCENCE borne on suppressed secondary shoots, usually several flowers reaching maturity per fascicle. FLOWERS with pedicels (2.5-)3-4.5(-5.5) mm; sepals predominantly deciduous. FRUIT bitter; with the stone globose or occasionally slightly longer than wide, 2-4.5 mm long, 2-4 mm wide, black to brown. 2 subspp; AZ, NM, CA, Mex.

Var. **pubescens** I.M. Johnst. (hairy). –STEMS hispidulous when young. LEAVES densely to sparsely hispidulous. –Dry desert washes, drainages, canyons, occasionally open slopes: Pima, Maricopa, Yuma, La Paz, cos.; 500-1500 m (1600-5000 ft); flowering throughout the year; AZ, CA, n Mex.

Condalia warnockii M.C. Johnst. (honors B.H. Warnock, Texas botanist, 1911-1998). Warnock's Snakewood. –Diffusely branched, 1-3.5 m tall, 1-3.5 m wide. STEMS many, bark gray-brown; primary lateral branches spreading to ascending; secondary lateral branches suppressed. LEAVES oblanceolate to elliptic to obovate or occasionally spatulate, 3-8(-9) mm long, 1-2.5(-3.5) mm wide, acute to occasionally obtuse, with base acute to somewhat attenuate, dull green to gray, slightly but distinctly wrinkled above, dull green beneath, sparsely to densely hispidulous; veins thick, somewhat raised and prominent, occupying much of the underside of young leaves. INFLORESCENCE borne on suppressed secondary shoots, usually 1-2 flowers reaching maturity per fascicle. FLOWERS with pedicels (0.5-)1-2.5(-3) mm; sepals predominantly persistent. FRUIT mildly or not bitter, with the stone slightly elongate, 2-4.5 mm long, 2-4 mm wide, black to light brown. 2 subspp; AZ, NM, TX, Mex.

Var. **kearneyana** M.C. Johnst. (honors T. H. Kearney, AZ botanist, 1874-1956). –LEAVES 1-3.5 mm wide. –Dry desert washes, drainages, canyons, occasionally open slopes: Greenlee, Graham, Cochise, Maricopa, Pinal, Pima cos.; 500-1500 m (1600-5000 ft); flowering throughout the year; AZ; Mex.

Frangula Mill.

Mar-Elise Hill

Shrubs or small trees, unarmed. STEMS several to many, erect to ascending, smooth; branches mostly alternate; twigs canescent; bud scales absent. LEAVES evergreen or deciduous, alternate, petiolate; blades elliptic to oblong or obovate, pinnately-veined, serrate to entire, pubescent to tomentose. INFLORESCENCES axillary cymes of 2-35 flowers. FLOWERS perfect, pedicellate; hypanthium hemispheric, 2 mm in diameter, loosely villous; sepals 5, yellow, triangular; petals 5, ca. 1 mm long; stamens 5; stigma 2-3-lobed. FRUITS drupes, purplish-black when ripe, spherical, glabrous; stones 2-3, smooth. –8 spp. in N. Amer. (2 in AZ). (Fragile; medieval name refers to the brittle twigs of alder buckthorn.) *Frangula* was formerly treated as a subgenus or section of the genus *Rhamnus*.

1. Leaves evergreen, usually white-tomentose beneath, elliptic; stigma 2-lobed; fruits 2-stoned ***F. californica***
- 1' Leaves deciduous, green beneath, elliptic to ovate or obovate; stigma 3-lobed; fruit usually 3-stoned. ***F. betulifolia***

Frangula betulifolia (Greene) Grubov. (birch-leaved). Birchleaf Buckthorn. –Shrubs to 3 m tall. STEMS brown to gray-brown. LEAVES thin or thick, deciduous; petioles (0.2-) 0.5-1.6 cm long; blades elliptic or oblong to obovate, 4.5-14.1 cm long, 1.9-9.3 cm wide,

green and pubescent (hirtellous when young) on both surfaces; margins serrate to subcrenate. FLOWERS 2-20(-38) per inflorescence; sepals 1-2 mm long; petals light yellow becoming brownish with age; stigma 3-lobed. FRUITS 0.5-1 cm wide; stones (2-)3(-4). [*Rhamnus betulifolia* Greene]. –2 subsp; NV to UT, s to NM, TX, and Mex.

1. Leaves obovate; plants of Colorado River Canyon and tributaries (Coconino, Mohave, and Navajo cos.).....subsp. *obovata*
- 1' Leaves oblong to elliptic; plants of streams and creeks in Apache, Cochise, Gila, Graham, Greenlee, Navajo, Pima cos. subsp. *betulifolia*

Subsp. **betulifolia** –Leaves thin, oblong to elliptic, usually more than 1¼ times as long as wide; veins thin, not prominent. –Stream and creek banks: Apache, Cochise, Gila, Graham, Greenlee, Navajo, Pima cos.; 1347-2341 m (4420-8800 ft); Apr-Sep; NV, UT, s to TX.

Subsp. **obovata** (Kearney & Peebles) Kartesz & Gandhi. –Leaves thick, obovate, usually less than 1½ times as long as wide; veins thick, prominent. –Hanging gardens, canyons, stream banks: Coconino, Mohave, Navajo cos.; 884-1433 m (2900-4700 ft); Apr; NV, NM.

Frangula californica A. Gray. California Coffeeberry. –Shrubs to 5.5 m tall. STEMS gray to red. LEAVES thick, evergreen; petioles 0.5-1.7 cm long; blades elliptic to obovate, 2.8-8.5 cm long, 1.4-3.8 (-4.5) cm wide, green, glabrous on the upper surface and glabrous to white-tomentose on the lower surface. FLOWERS 4-27 (-34) per inflorescence; sepals 2 mm long; petals brownish; stigma 2-lobed. FRUITS 0.6-1.2 cm wide; seeds 2. [*Rhamnus californica* Eschsch.]. –6 subsp. (1 in AZ); OR, CA & NV, west to NM.

Subsp. **ursina** (Greene) Kartesz & Gandhi. (type from Bear Mtn., NM). –LEAVES green and nearly glabrous on upper surface, paler green and white-tomentose beneath; margins slightly revolute, serrate to entire. [*R. ursina* Greene, *R. californica* Eschsch. subsp. *ursina* (Greene) C.B. Wolf, *R. tomentella* Benth. subsp. *ursinus* (Greene) Sawyer]. –Chaparral, coniferous woodlands, riparian: Apache, Coconino, Cochise, Gila, Graham, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai cos.; 762-2545 m (2500-8350 ft); May-Sep; NV, CA, NM.

Frangula ×blumeri (Greene) Kartesz & Gandhi (pro sp.) [= *F. betulifolia* × *californica*] was based upon type material collected from the Chiricahua Mountains (*Blumer 1290*, in part). It was thought to be a hybrid between this variety and *F. betulifolia*. All AZ specimens examined for this treatment from the Chiricahua Mountains fit well into *F. californica* subsp. *ursina* and do not appear to be hybrids.

Rhamnus L. Buckthorn

Suzanne Neal

Shrubs to small trees, unarmed. STEMS several to many, ascending to erect, rigid, gray to brown, pubescent to glabrous; bud scales present, 3 mm long. LEAVES evergreen or deciduous; alternate to nearly opposite, petiolate; blades lanceolate, oblong or ovate to round, serrulate, toothed, spinescent or entire, glabrous to pubescent, pinnately veined. INFLORESCENCES axillary, cymose, of 1-10 flowers. FLOWERS imperfect, pedicellate; hypanthium hemispheric; sepals 4, greenish-yellow, triangular; petals 0 or 4; stamens 4; style branched. FRUITS drupes, red or black at maturity, globose; stones 2, tan, rounded; seeds

grooved. –125 spp. (3 in AZ); cosmopolitan. (Greek: *Rhamnus*, ‘various prickly shrubs’). Some members are valued for medicine or dyes. The fruit is eaten by several species of birds.

Rhamnus cathartica L. (Common Buckthorn) is a commonly cultivated species often armed with blunt thorns. It is readily separated from the native species by its opposite leaves, 5-merous flowers and a black drupe with four stones. This species may persist from cultivated plants. *Rhamnus cathartica* may also naturalize, especially in riparian areas, although there are no herbarium specimens to document this in AZ.

1. Leaves deciduous; blades oblong to lanceolate; petals present; drupes black at maturity ... *R. serrata*
- 1' Leaves evergreen; blades ovate to round; petals absent; drupes red at maturity.
 2. Leaf blade < 20 mm long, flat; margins toothed to entire; Pima co. *R. crocea*
 - 2' Leaf blade mostly > 20 mm long, undulate; margins spinescent; widespread *R. ilicifolia*

Rhamnus crocea Nutt. (saffron-colored). Redberry Buckthorn. –Shrubs 1.5-4 m (ours less than 2 m) tall. STEMS gray-green, glabrous, ascending, sometimes branching from base. LEAVES evergreen, alternate, with petioles 2-3 mm long; blades obovate to ovate, 7-20 mm long, 8-15 mm wide, toothed or entire, glabrous, flat; apex obtuse to emarginate. FLOWERS: petals absent, with pedicels 2-3 mm long. FRUITS red at maturity, 3-5 mm long. –Dry washes and canyons: Pima co.; 640-1,100 m (2,100-3600 ft); Mar-Apr; CA.

Rhamnus ilicifolia Kellogg (leaves resembling those of holly, *Ilex*). Hollyleaf Redberry. –Shrubs < 4 m tall. STEMS ascending, gray-brown, glabrous to densely hairy. LEAVES evergreen, alternate; petioles 2-6 mm long; blades ovate to round, 2-4 cm long, 1.2 –3 (-4) cm wide, spinescent to spinose-dentate, glabrous or pubescent, concave below, undulate; apex obtuse to rounded. INFLORESCENCES of 1-10 flowers. FLOWERS with pedicels 2-4 mm long; petals absent. FRUITS 4-6 mm, red at maturity. [*Rhamnus crocea* Nutt. ssp. *ilicifolia* (Kellogg) C. B. Wolf; *Rhamnus crocea* Nutt. var. *ilicifolia* (Kellogg) Greene]. –Dry slopes, mountain canyons and open hillsides: Coconino, Gila, Graham, Maricopa, Mohave, Pima, Pinal, Yavapai cos.; 646-2000 m (2,120-6,300 ft); Mar-Jun; CA, NV, OR; Mex.

Rhamnus serrata Humb. & Bonpl. ex J. A. Schultes (serrate leaves). Saw-leaf Buckthorn. –Shrubs to small trees, 2-5 m tall. STEMS erect, gray-brown, slender, young stems pubescent becoming glabrous, often smooth and lustrous. LEAVES deciduous, alternate to nearly opposite; petioles 3-4 mm long; blades oblong, lanceolate or elliptic; 2-5 (5.8) cm long, 1.0-1.6 cm wide, serrulate to crenulate, yellowish-brown and pubescent below; apex obtuse. INFLORESCENCES of 1-5 flowers. FLOWERS with pedicels 2-5 mm long; petals 4, greenish-yellow, ca. 2 mm long. FRUITS 4-6 mm long, black at maturity. [*R. fasciculata* Greene; *R. smithii* Greene subsp. *fasciculata* (Greene) C.B. Wolf]. –Mountain canyons, open hillsides and stream banks: Apache, Cochise, Coconino cos.; 1,520-2,300 m (5,000-7,500 ft); Apr-Jun; CO, TX, NM; Mex.

Sageretia Brongn.

Laura Smith Davis

Shrubs, ours weakly armed. STEMS several to many, arching, lightly furrowed; branches opposite to subopposite, pubescent when young; bud scales absent. LEAVES deciduous, opposite to subopposite, petiolate; blades elliptic, oblong or obovate, pinnately-veined, serrate to entire, tomentulose, becoming glabrous. INFLORESCENCES of axillary clusters and terminal panicles. FLOWERS perfect, sessile to nearly sessile, hypanthium hemispheric, shallow; sepals 5, triangular; petals 5; stamens 5; style 3-lobed; ovary superior. FRUITS somewhat fleshy black drupes, spherical to obovoid; stones 3. – More than 30 spp. worldwide (1 in AZ). (For French botanist, Augustin Sageret, 1763-1851).

The fruits of many species are edible. In China the leaves of *Sageretia theezans* (L.) Brongn. are used as a tea substitute.

Sageretia wrightii S. Wats. (in honor of Botanist and surveyor Charles Wright 1811-1885). Wright's Mock Buckthorn. – Shrub, slender, spreading, weakly armed, 1-4 m tall. STEMS brown to gray-brown, branching becoming very dense with age, pubescent when young, glabrescent with age. LEAVES stipules black to brown; petioles pubescent, 1-2 mm long; blade 8-15(-30) mm long, 4-11(-18) mm wide, thin, shiny green, villous, pinnately-veined, entire to serrate, woolly when young, soon glabrous; midvein prominent beneath. FLOWERS minute; hypanthium 1.2-1.8 mm diameter; sepals yellowish green; petals creamy white to yellow, ca. 0.5 mm long. FRUITS flattened, star-shaped, the floral cup persisting on proximal end of fruit. – Dry rocky canyons and hillsides, desert grassland and sw oak woodlands: Cochise, Gila, Graham, Greenlee, Maricopa, Navajo, Pima, Pinal, Santa Cruz cos.; 900-1525 m (3000 – 5000 ft); Mar-Sep; NM, Trans-Pecos region TX; Son. to Jal., Mex.

Some branches have opposite to subopposite slender thorns, whereas others may be more leafy and less thorny. Leaf margins vary within an individual from entire to serrate. Leaves are larger and more numerous on plants in riparian areas and dry washes. In some instances *Sageretia wrightii* has been confused with *Colubrina californica*, however, the leaves of *Sageretia wrightii* are shiny green and thin, whereas the leaves of *Colubrina californica* are thicker and dull gray-green to yellowish green. The fruits of *C. californica* are woody capsules whereas the fruits of *S. wrightii* are fleshy drupes.

Ziziphus P. Mill. Jujube, Gray Thorn

Laura Smith Davis

Armed shrubs (in ours). STEMS several to many, becoming dense with age, divaricate, rigid; bark smooth to lightly furrowed to striate; twigs canescent to glabrate to glaucous; bud scales absent. LEAVES deciduous or evergreen, alternate or fascicled, petiolate; blades elliptic to linear-oblong to ovate, pinnately-veined, entire to crenate to serrate, glabrate to canescent; stipules brown. INFLORESCENCES of axillary clusters. FLOWERS perfect, pedicellate; hypanthium hemispheric; sepals, triangular; petals 5; stamens 5; style 2-lobed. FRUITS 1-seeded drupes. – 150 spp. worldwide (1 in AZ), in warmer parts of the Old and New world. (from zizufun, a Persian word, from which the an ancient Greek name is derived).

The fruits of *Ziziphus jujuba* are edible and used either fresh, dried or preserved in cooking and candy making. *Ziziphus jujuba* was collected in the Tonto National Forest in

Gila Co. in 1992. Natural recruitment of the escaped cultivar occurred near a campground. The tree, *Z. jujuba*, may be distinguished from *Z. obtusifolia* by its larger glossy serrate leaves, which are usually 2-5 cm long, and its paired recurved stipular spines.

Ziziphus obtusifolia (Hook. ex Torr. & A. Gray) A. Gray (obtuse-leaved). Lotebush, Gumdrop Bush, Gray Thorn. –Shrubs to 4 m tall, armed. STEMS green to gray, or brown, canescent to glaucous; branchlets thorn-tipped, occasionally with axillary recurved thorns, the thorn tips mostly glabrous and brown. LEAVES thin or thick, deciduous; stipules triangular; petioles 0.5- 5 mm long; blades linear to narrowly elliptic to oblong or ovate, 5-20 (-27) mm long, 2-15 mm wide, green to pale green, glabrous to canescent; margins entire to serrate or crenate. FLOWERS inconspicuous, (1-) 2-15 (sometimes more) per inflorescence; hypanthium 1.0-2 mm long, glabrous to canescent; sepals yellowish green, glabrous to canescent; petals ca. 1 mm, white to light green; stigma 2-lobed. FRUITS blue to purple to black with white waxy bloom, 5-8 mm wide; pedicels becoming thicker in fruit, the floral cup persistent. –2 vars., both in AZ, CA to OK; s to Mex.

The leaf and branch morphology of *Z. obtusifolia* is variable. Solitary serrate to crenate ovate leaves with marginal glands on thorn-tipped canescent branchlets are representative of the new growth; older stems have leaves that are entire, oblong, elliptical or linear and are arranged in short shoots. The short shoots may become woody with age. Elongation of the short shoot into new thorn-tipped branches may occur, being evident by a leaf scar. The leaf size is dependent upon climate, habitat and season.

1. Stems canescent to glabrate; leaves thick, mostly canescent; hypanthium canescent, found throughout AZ var. *canescens*
- 1' Stems mostly glabrous; leaves thin, mostly glabrous; hypanthium glabrous, Cochise Co. var. *obtusifolia*

Var. ***canescens*** (A.Gray) M.C. Johnst. –Shrubs to 4 m tall. Leaves thick, mostly canescent. FLOWERS: hypanthium canescent. FRUITS 5-8 mm wide. [*Condalia lycioides* (A. Gray) Weberb. var. *canescens* (A. Gray) Trel.] – Mesas, canyon slopes and desert grasslands; Cochise, Coconino, Gila, Graham, Greenlee, Maricopa, Mohave, Pima, Pinal, Santa Cruz, Yavapai, Yuma cos.; 330-1500 meters (1000-5000ft); May – Sep; NM,CA, NV, UT; Sonoran Desert, Mex.

A decoction made from the roots of *Z. obtusifolia* var. *canescens* was used as a treatment for sore eyes by the Pima Indians and the roots have been used in place of soap in parts of Mex. and the Grand Canyon region of n AZ.

Var. ***obtusifolia*** (Hook. ex Torr. & A.Gray) A. Gray . –Shrubs to 3m tall. LEAVES thin, mostly glabrous. FLOWER: hypanthium glabrous. FRUITS 7-8 mm wide. [*Condalia lycioides* (Gray) Weberb.] –Occurring on gypsum soils in Cochise co.; 1150– 1250 meters (3800-4100 ft); May-Sep; NM, TX, OK; Chihuahuan Desert, Mex.

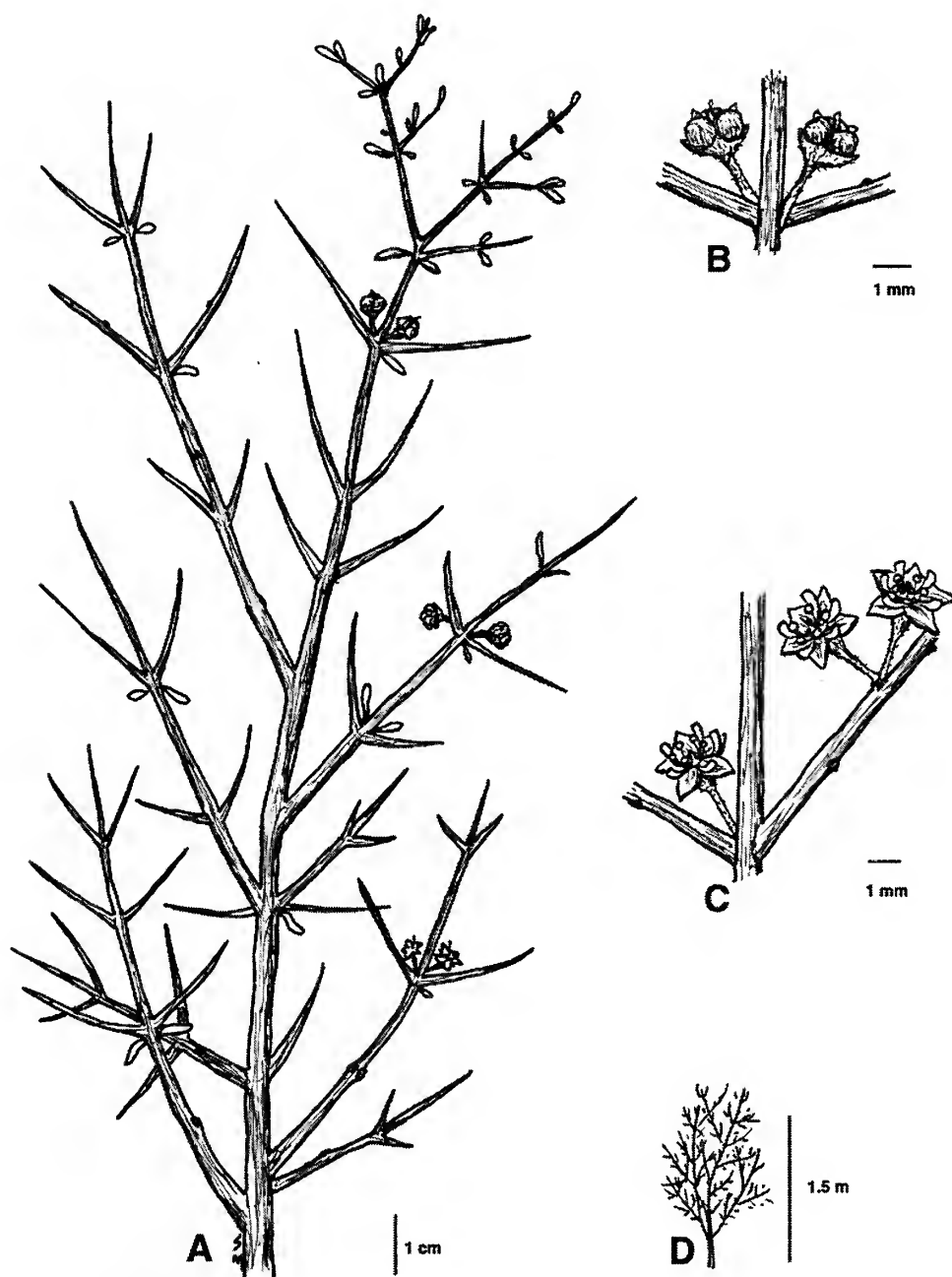
ACKNOWLEDGEMENTS

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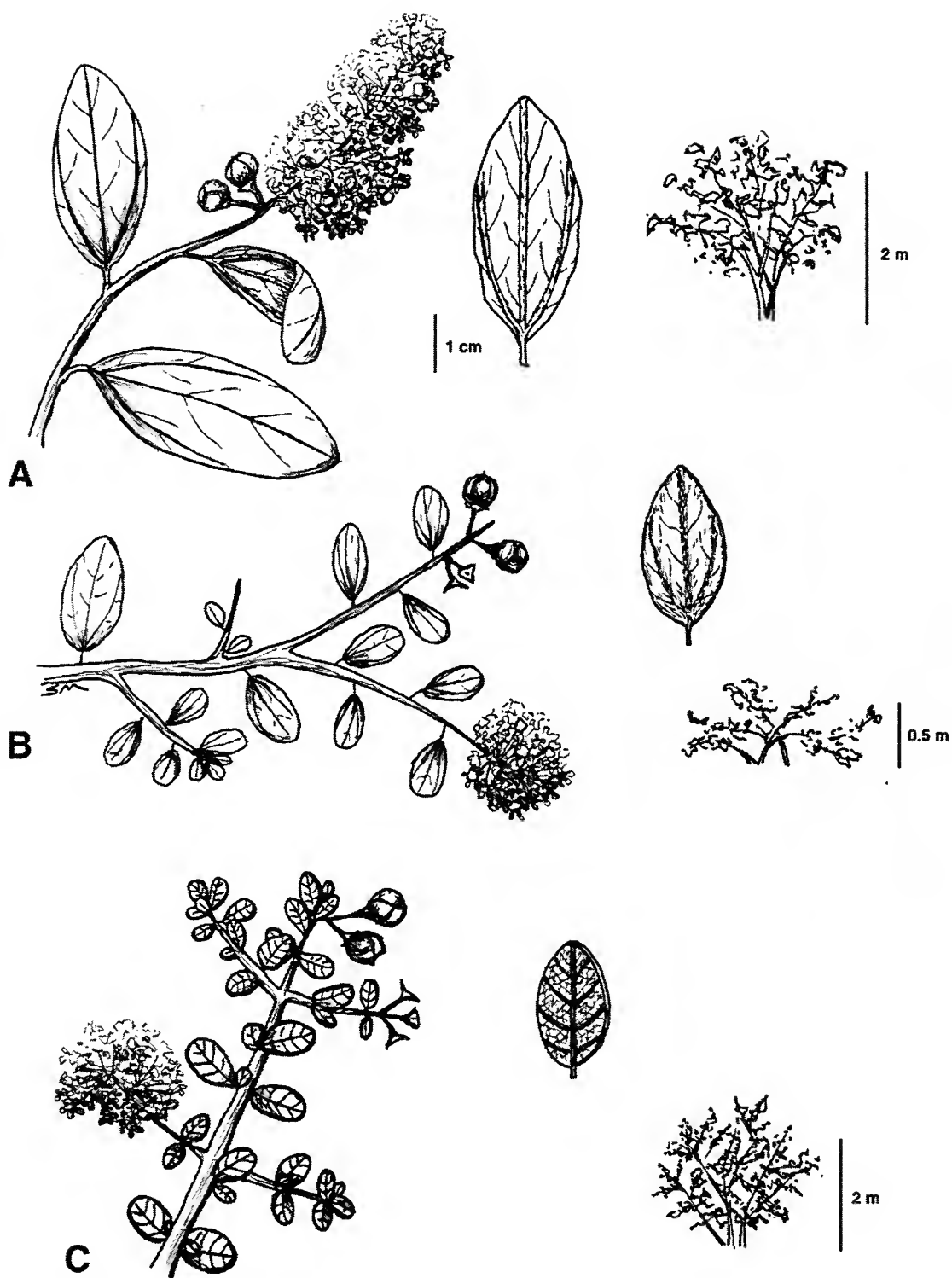
Hammond reviewed the treatment. Special thanks to Dieter Wilken for bringing Rogers McVaugh's discussion of *Ceanothus* to our attention.

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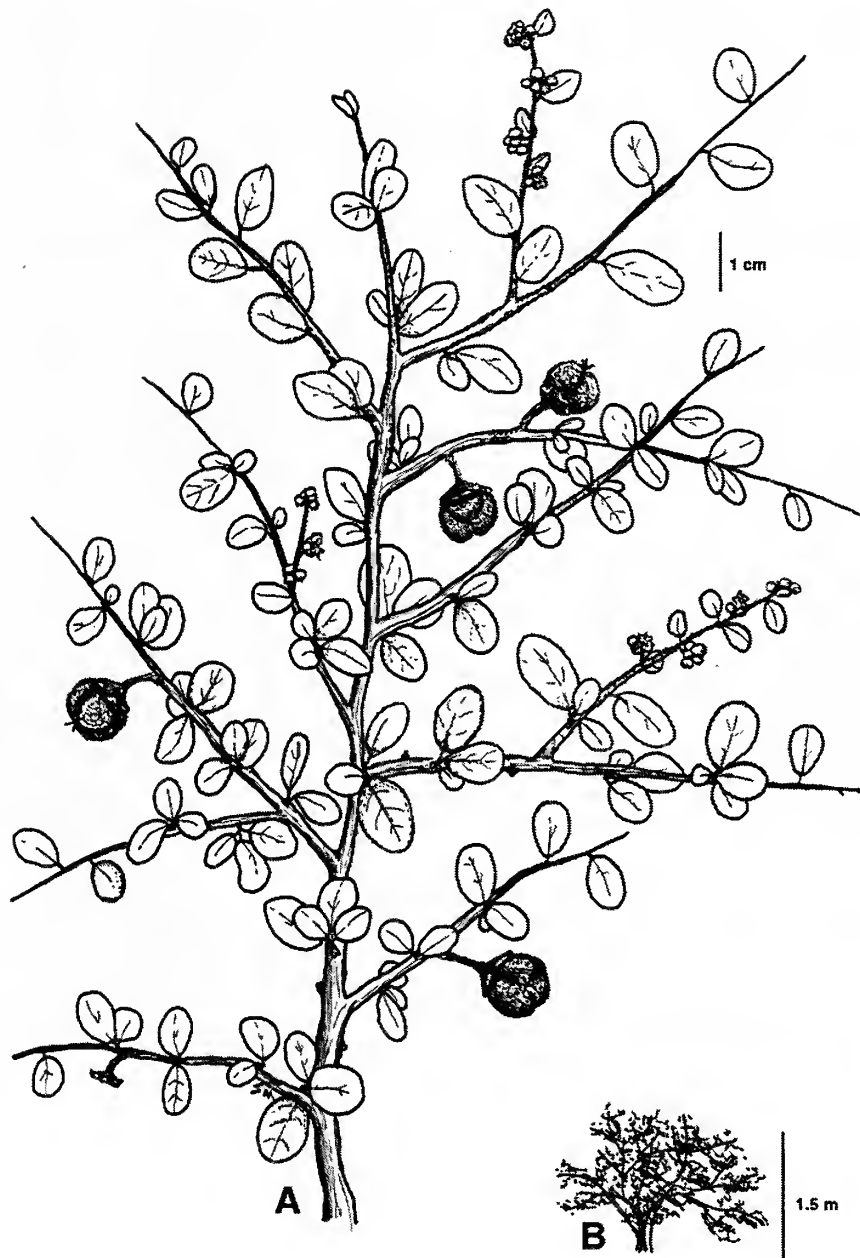
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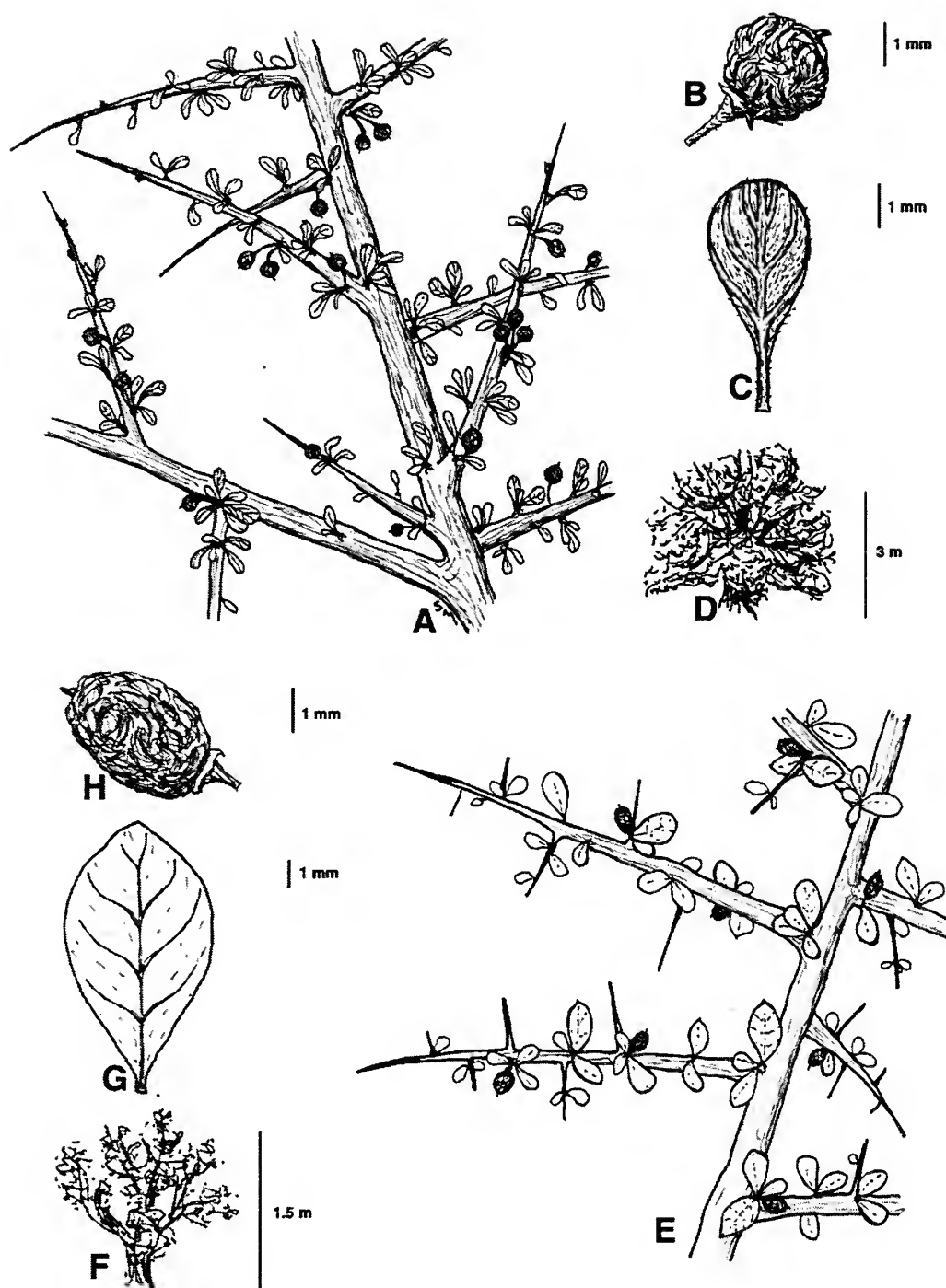
Rhamnaceae Fig 1. *Adolphia infesta*. A, branch; B, fruit close-up; C, flower close-up; D. habit.



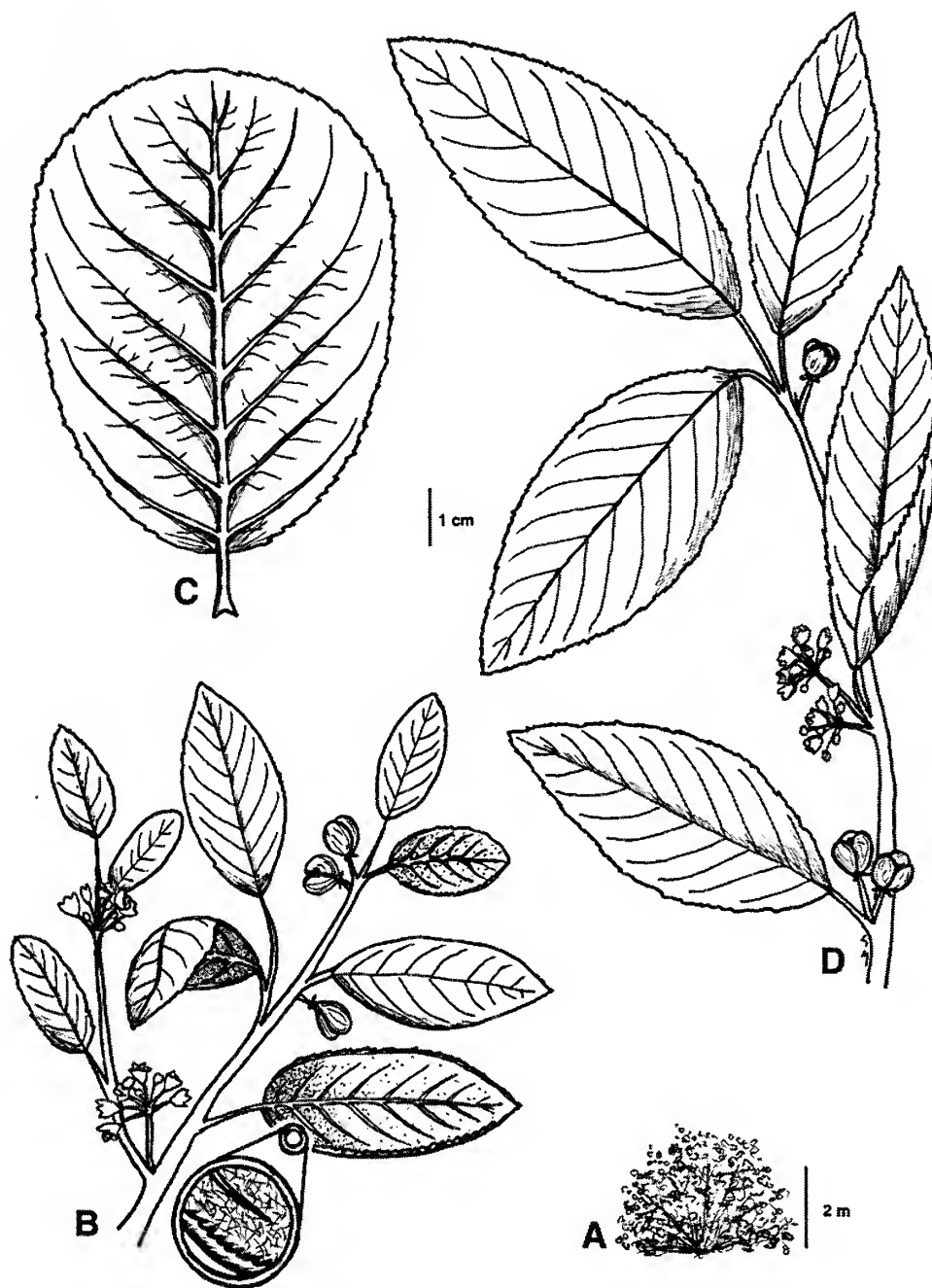
Rhamnaceae Fig 2. *Ceanothus*. A, *C. integerrimus* branch, leaf, habit; B, *C. fendleri* branch, leaf, habit; C, *C. vestitus* branch, leaf, habit.



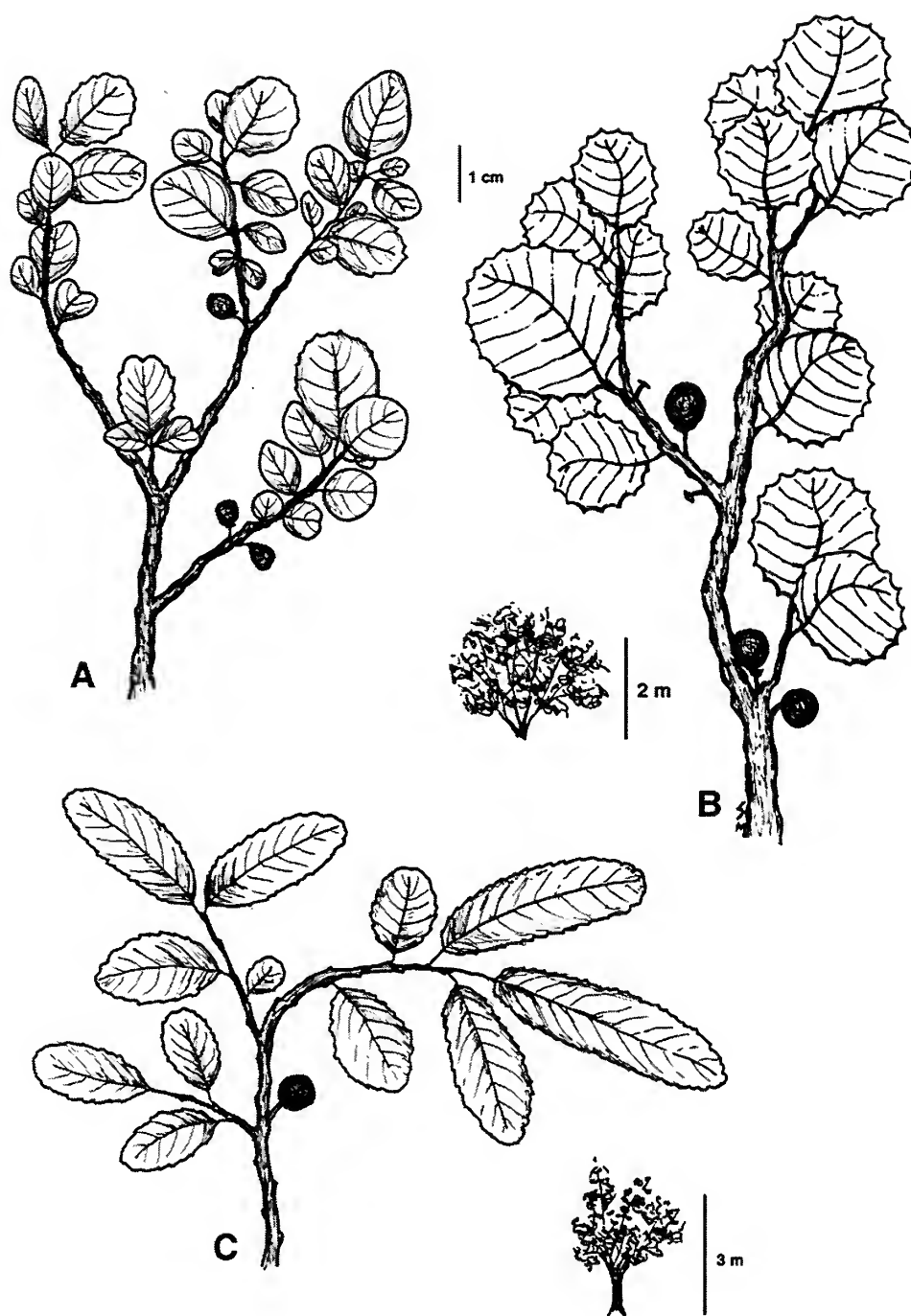
Rhamnaceae Fig 3. *Colubrina*. A, *C. californica* branch; B, typical habit.



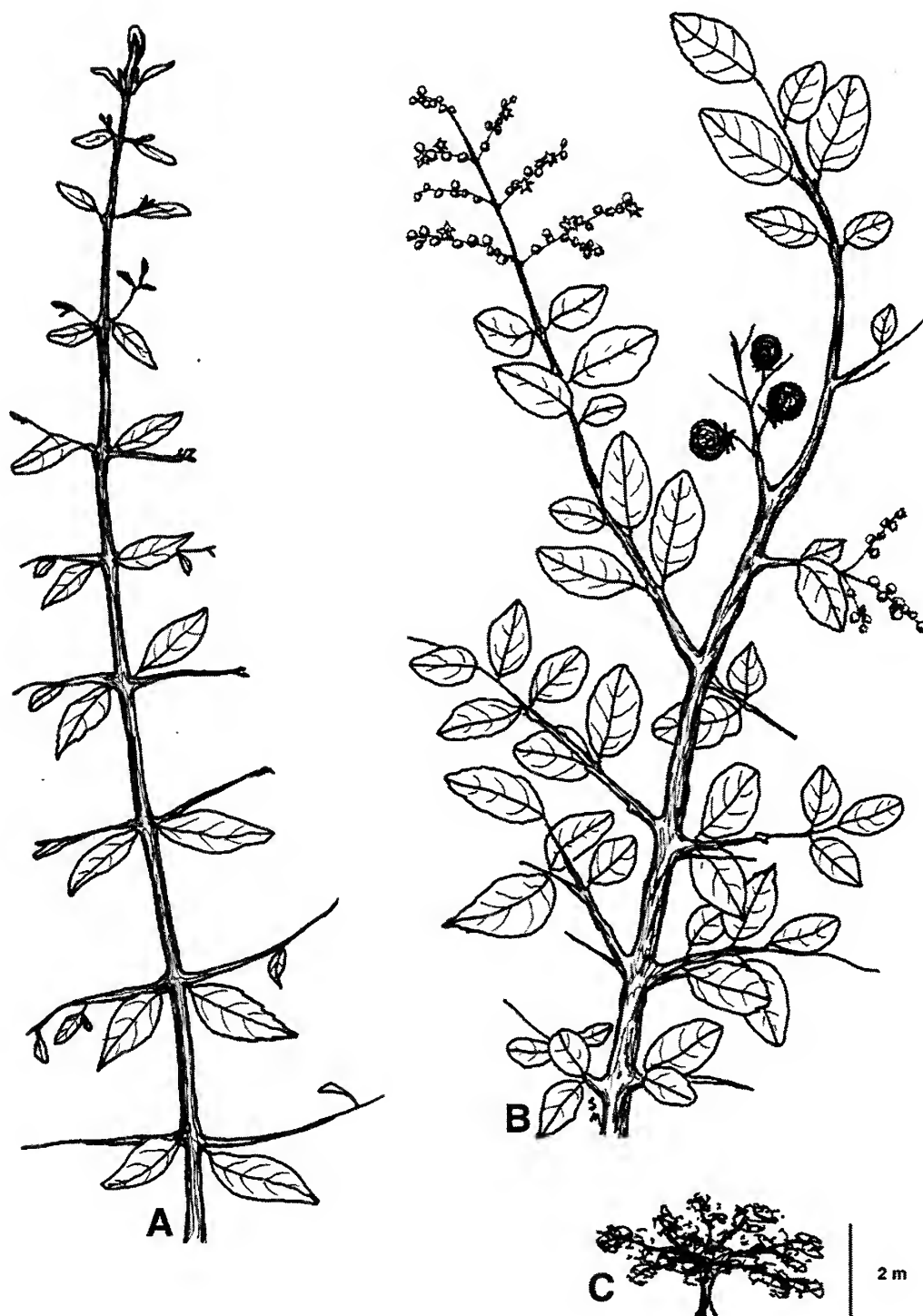
Rhamnaceae Fig 4. *Condalia*. A-D, *C. warnockii* var. *kearneyana*. A, branch; B, fruit close-up; C, leaf close-up; D, habit. E-H, *C. correllii*. E, branch; F, habit; G, leaf close-up; H, fruit close-up.



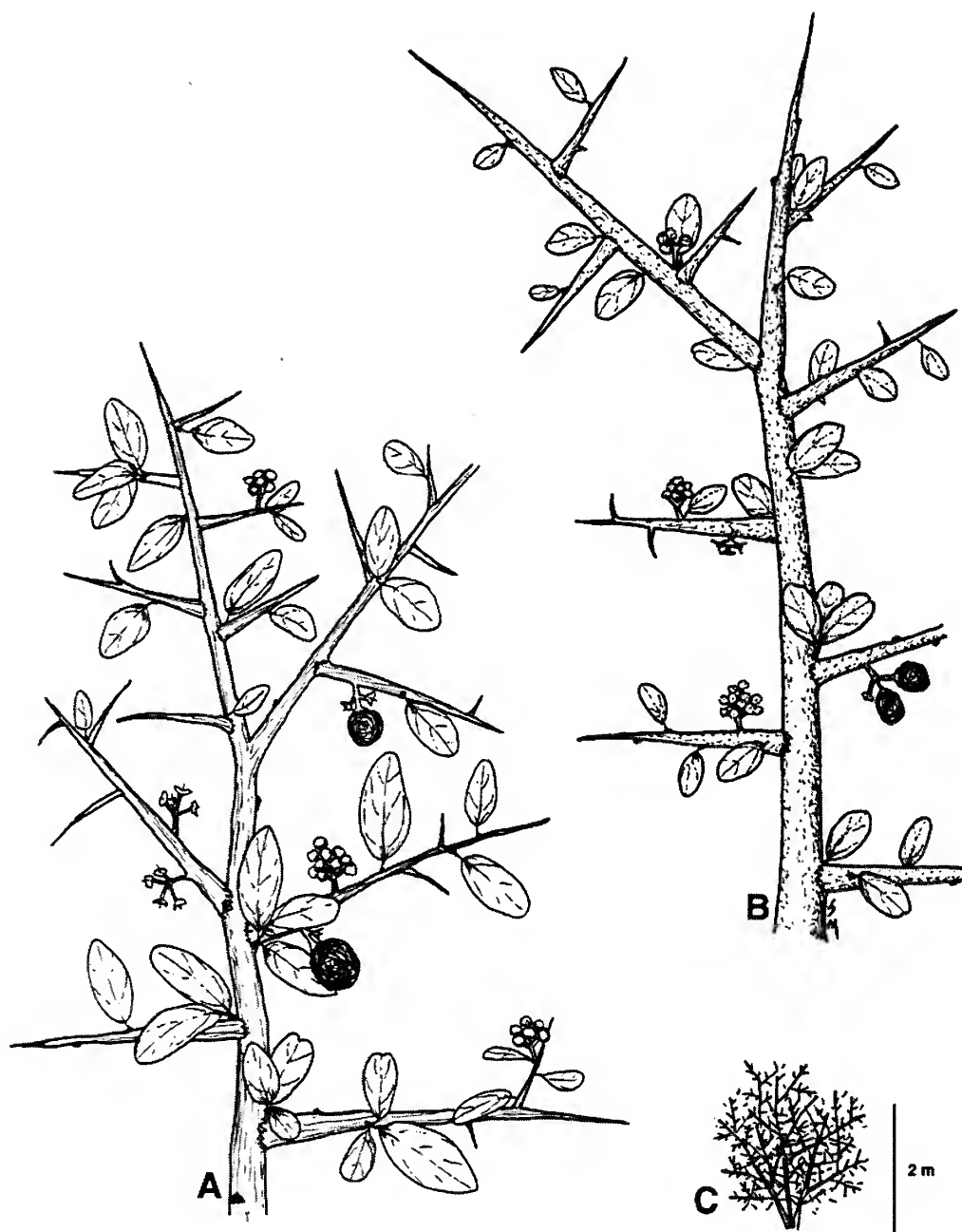
Rhamnaceae Fig 5. *Frangula*. A, typical habit; B, *F. californica* subsp. *ursina* branch (inset detail of lower leaf surface); C, *F. betulifolia* subsp. *obovata* leaf; D, *F. betulifolia* subsp. *betulifolia* branch.



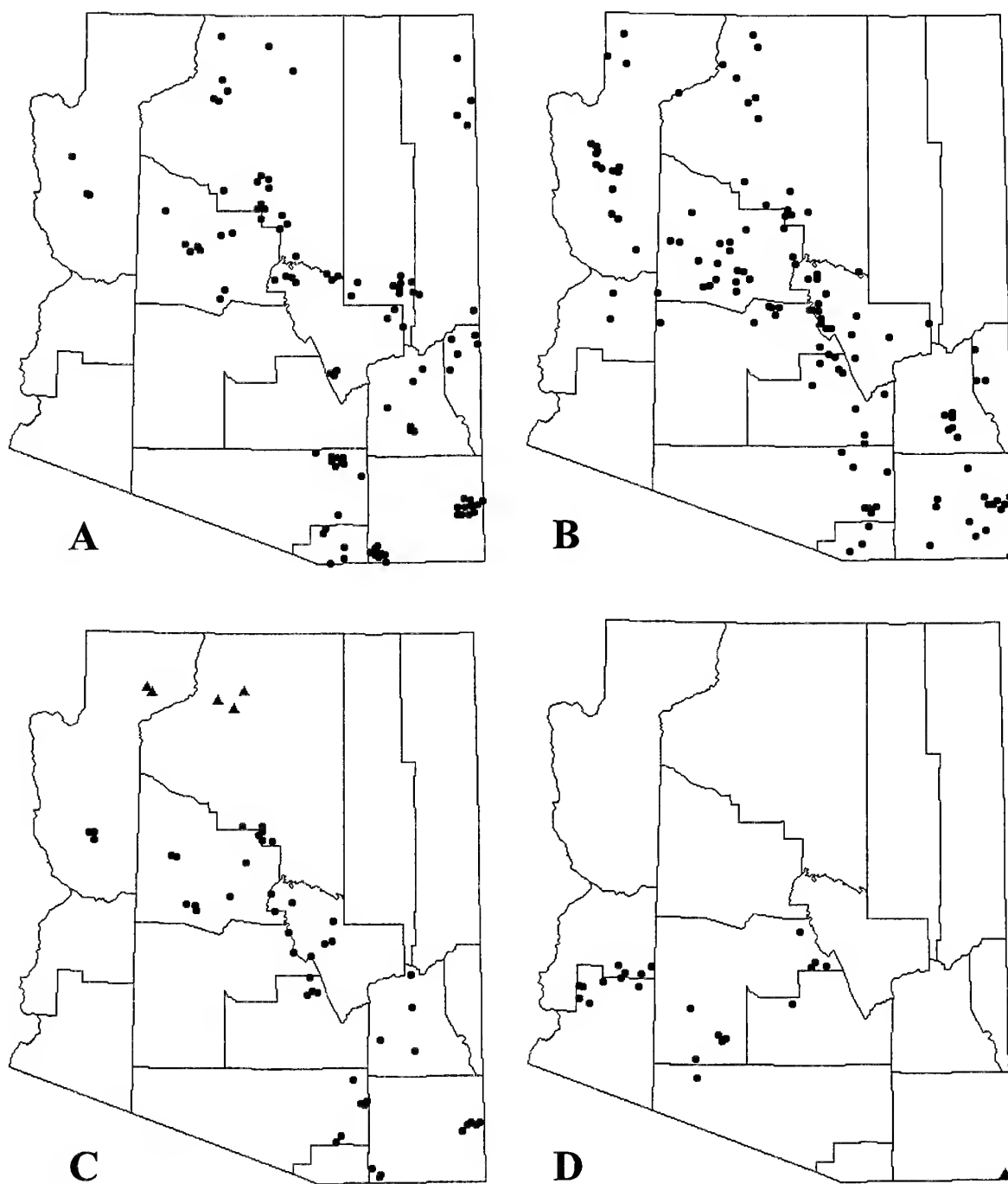
Rhamnaceae Fig 6. *Rhamnus*. A, *R. crocea* branch; B, *R. ilicifolia* branch and typical habit; C, *R. serrata* branch and typical habit.



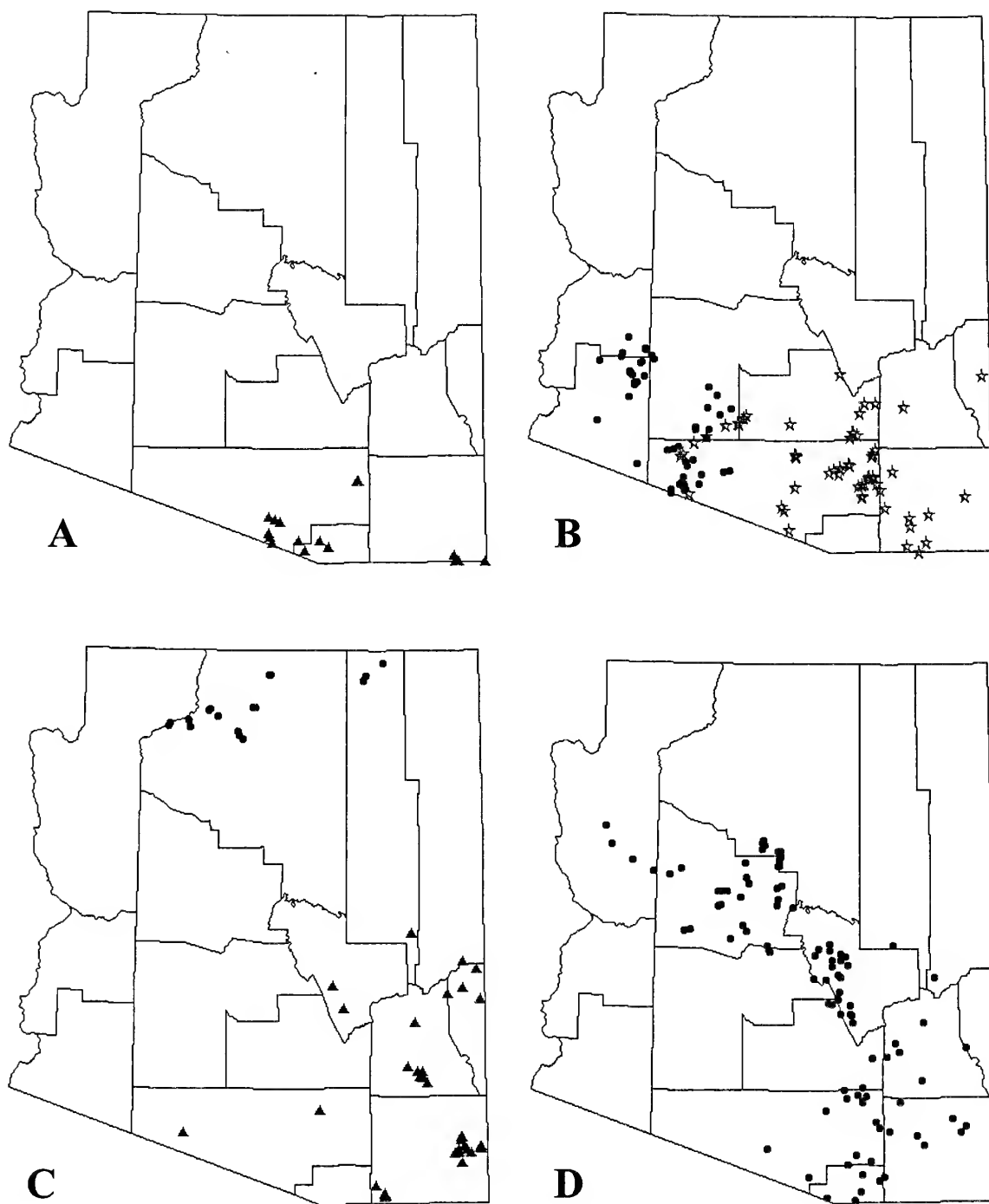
Rhamnaceae Fig 7. *Sageretia*. A, *S. wrightii* new growth; B, *S. wrightii* mature branch; C, typical habit.



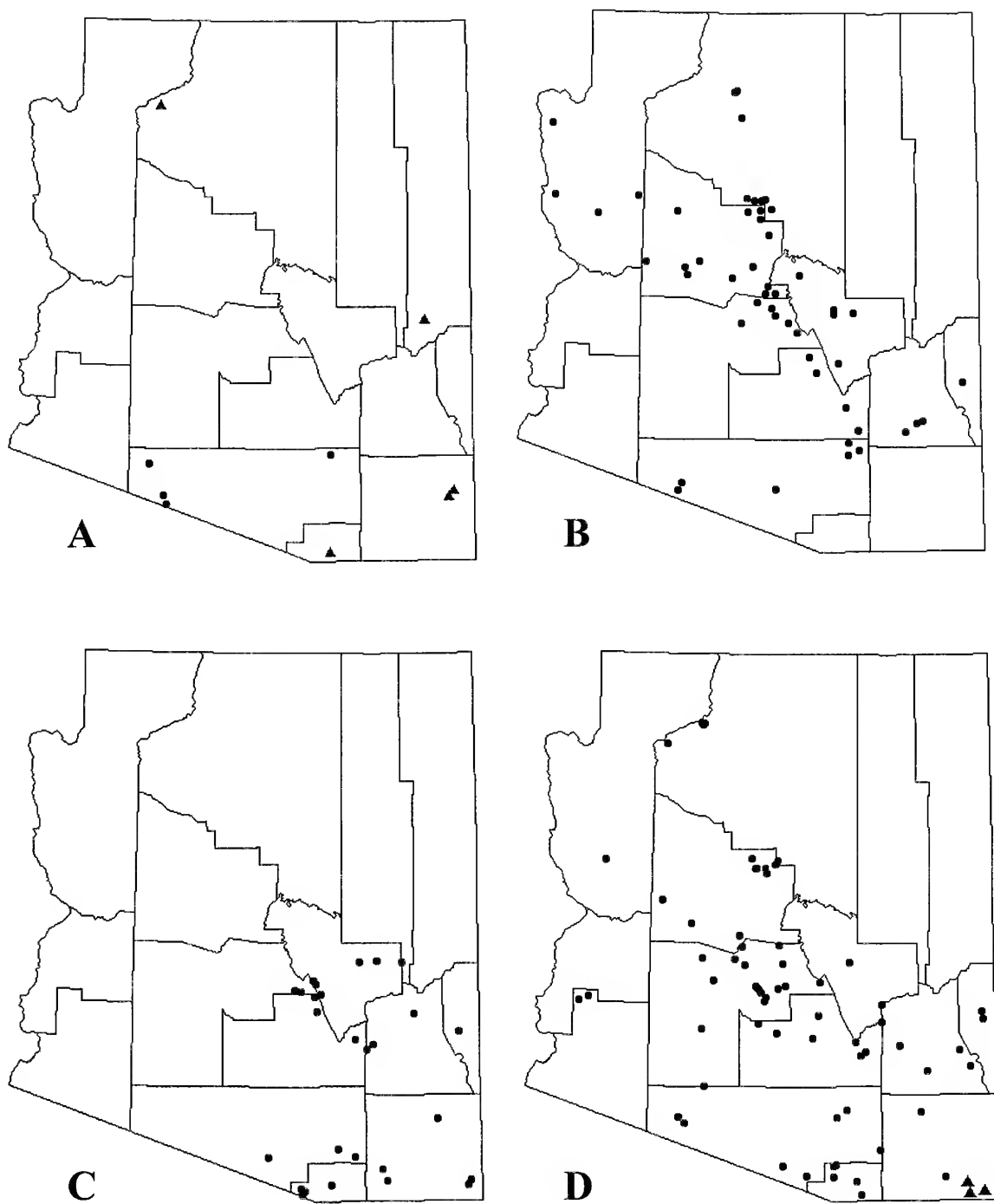
Rhamnaceae Fig 8. *Ziziphus*. A. *Z. obtusifolia* var. *obtusifolia* branch; B, *Z. obtusifolia* var. *canescens* branch; C, typical habit of *Z. obtusifolia* var. *canescens*.



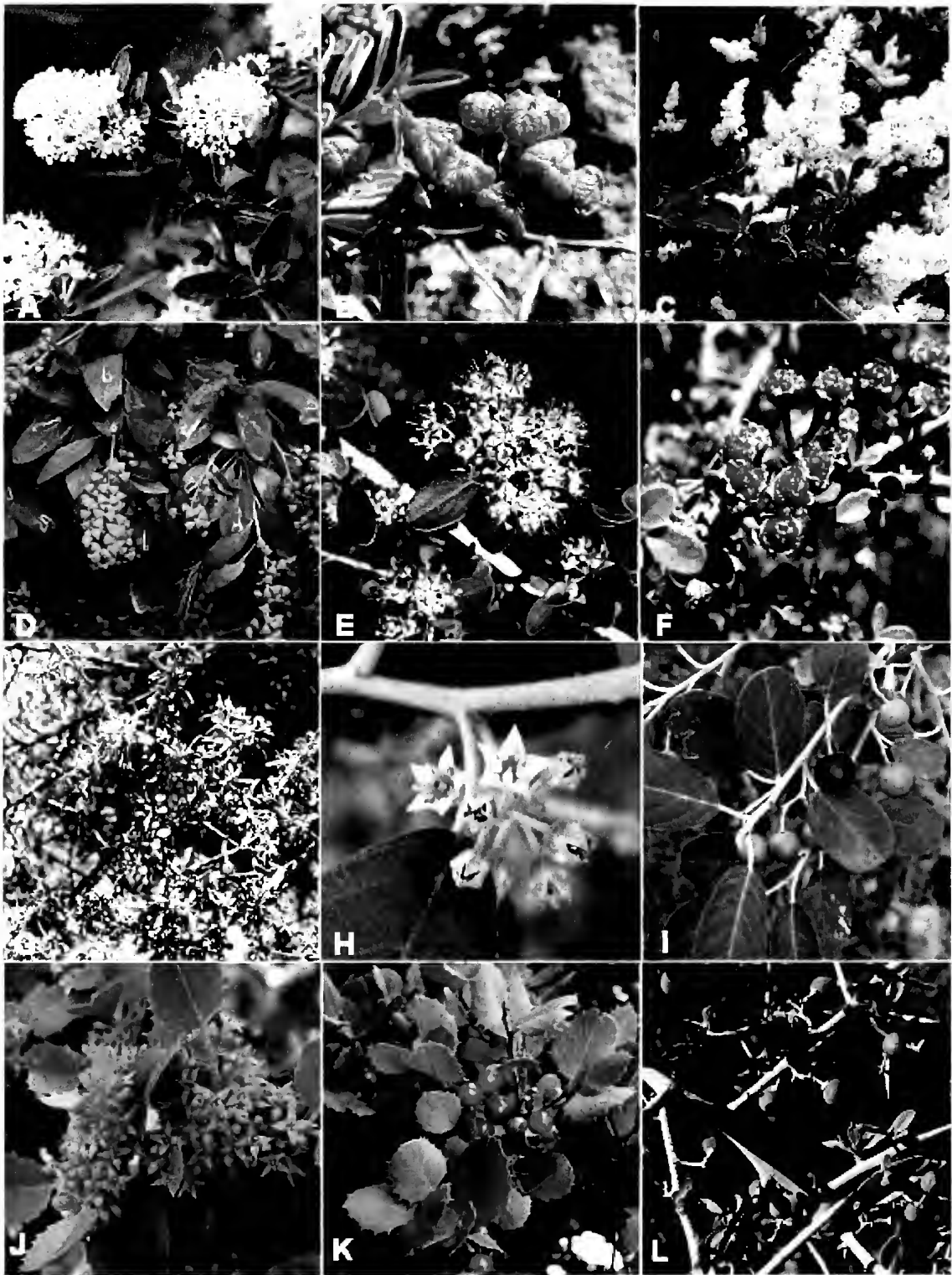
Rhamnaceae Fig 9. Distribution of *Ceanothus*. A, *C. fendleri*; B, *C. vestitus*; C, *C. integerrimus* (●), *C. martini* (▲); D, Distribution of *Adolphia infesta* (▲), and *Colubrina californica* (●).



Rhamnaceae Fig 10. A, Distribution of *Condalia correllii*; B, Distribution of *Condalia globosa* var. *pubescens* (●), *C. warnockii* var. *kearneyana* (*); C, Distribution of *Frangula betulifolia* subsp. *obovata* (●); *Frangula betulifolia* subsp. *betulifolia* (▲); D, Distribution of *Frangula californica*.



Rhamnaceae Fig 11. A, Distribution of *Rhamnus crocea* (●) and *R. serrata* (▲); B, Distribution of *Rhamnus ilicifolia*; C, Distribution of *Sageretia wrightii*; D, Distribution of *Ziziphus obtusifolia* var. *canescens* (●) and *Z. obtusifolia* var. *obtusifolia* (▲).



Rhamnaceae Fig. 12. A-B, *Ceanothus fendleri*: A, flowers; B, fruit. C-D, *Ceanothus integerrimus*: C, flowers; D, fruit. E-F, *Ceanothus vestitus*: E, flowers; F, fruit. G, *Condalia globosa*. H-I, *Frangula californica*: H, flowers; I, fruit. J-K, *Rhamnus ilicifolia*: J, flowers; K, fruit. L, *Ziziphus obtusifolia*. Photos A-F, H-L by Max Licher; photo G by Kyle Christie.

INDEX TO FAMILIES OF THE VASCULAR PLANTS OF ARIZONA

Bolded treatments are published in volumes 26, 27, 29, 30, 32, 33, and 35 of the *Journal of the Arizona-Nevada Academy of Science* (JANAS) or volume 1 or 2 of *CANOTIA*. Unbolded entries indicate families with no treatments published to date. Figure numbers refer to illustrations in the "Key to Families of Vascular Plants in Arizona" in JANAS 35(2).

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